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INTERNATIONAL ABSTRACT

Official Journal American Congress of Physical Therapy

Volume XVIII October, 1937 No. 10

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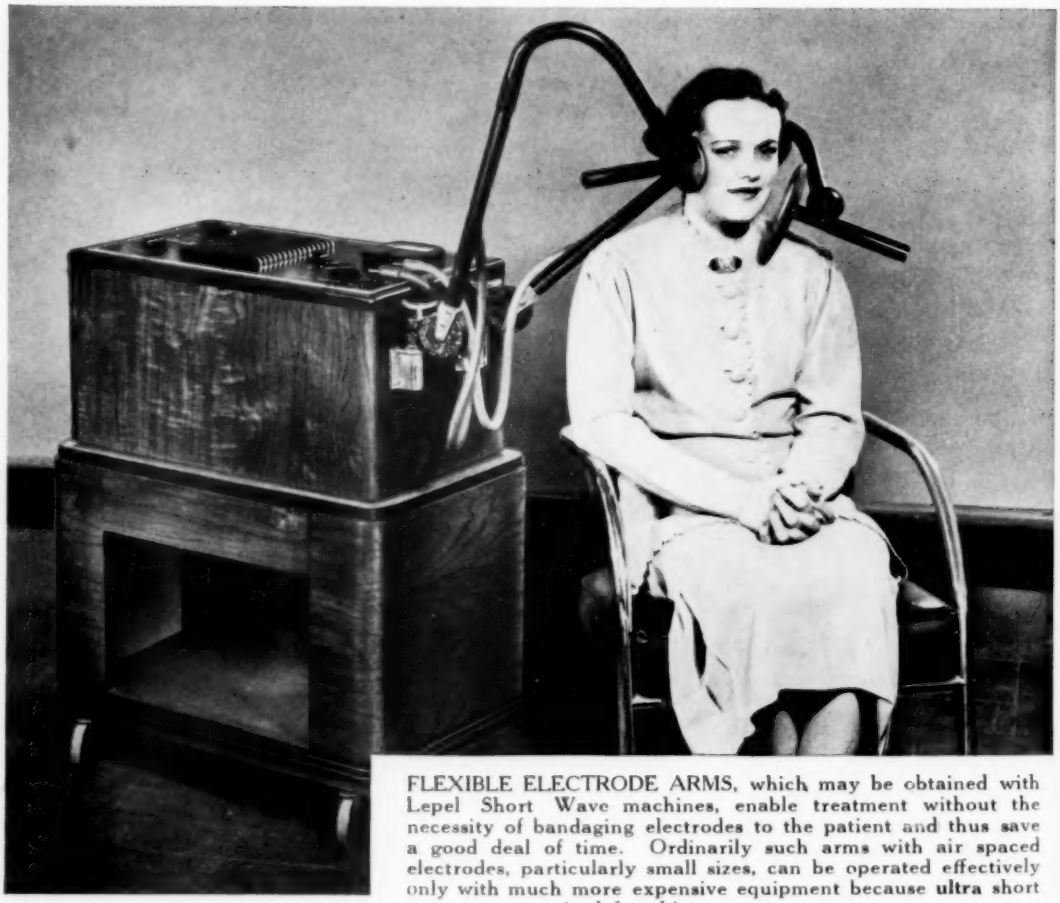

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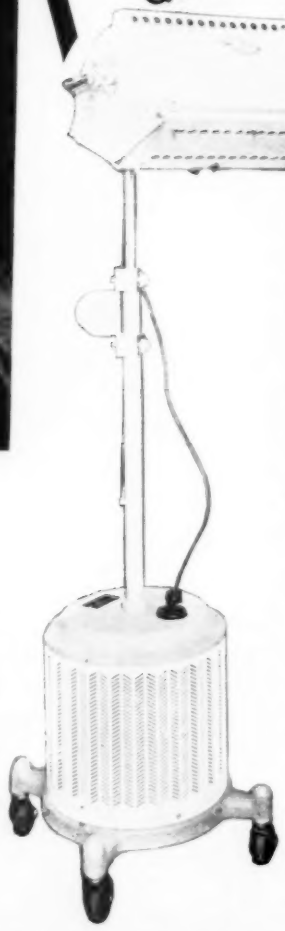

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DOSIMETRY IN SHORT WAVE THERAPY

An Instrument for Dosage Determination of Patient's Circuit

E. MITTELMANN, Eng. D., Ph.D.

Consulting Engineer

VIENNA

In an address delivered before the section on physics of the International Congress on Short Waves I submitted the physical fundamentals of a new method of measurement which I have developed. Considering the importance of this problem to the medical profession* and the circumstance that the purposive use of an apparatus is assured only by familiarity with its manner of effectiveness, these fundamentals are presented here at some detail and in a form to be understood also by physicians. It is scarcely necessary to point out the especial importance of dosimetry in short wave therapy. To elucidate the underlying conditions it is essential to introduce the subject by a uniform definition of some important physical concepts.

The high frequency energy which is commonly interpreted as the output of the apparatus is not to be confused with the same energy actually absorbed by an object under treatment. However, it is precisely the latter energy which has any relation to biologic effects and which therefore must be controllable by technical measurement. It is not within the province of the engineer to give the physician directions or advice about medical problems, but it is his mission to place at his disposal the means to facilitate visualization of the physical conditions of methods of therapy.

Conditions for Dosimetry

If dosimetry is to satisfy all demands which can reasonably be placed upon it, the following are the minimum conditions which must be fulfilled:

1. The measurement of power must register the actual high frequency energy absorbed by the patient and, if possible, that energy alone.

2. The measurement must be available during treatment in a manner to permit reading off a scale ranging from zero to maximum value. Only such a method of measurement which facilitates constant control of treatment meets with the essential demands.

3. Whenever employed the method must have no influence on the usual medical technic; in other words, the measurement should be possible irrespective of the size or position (air-distance) of the electrodes and for all objects under treatment.

The first condition presupposes that all methods of measurement which register in addition to the patient's energy also that radiated by the apparatus into space must be eliminated. This shortcoming is more or less inherent in all measurements of currents because they include the total electrode current; that is that part of the current which is equivalent to the radiation power.

The only way actually to measure the energy absorbed by the patient under treatment is by first determining the "equivalent patient's resistance." Each oscillatory circuit, consisting of self-induction and capacity, sustains a certain resistance loss which is the total of the resistance of the coil and that of the condenser (fig. 1a). If oscillations appear in the circuit or, in other words, if there is tension at the terminals (theoretically labeled A-B)

* See editorial in this issue.

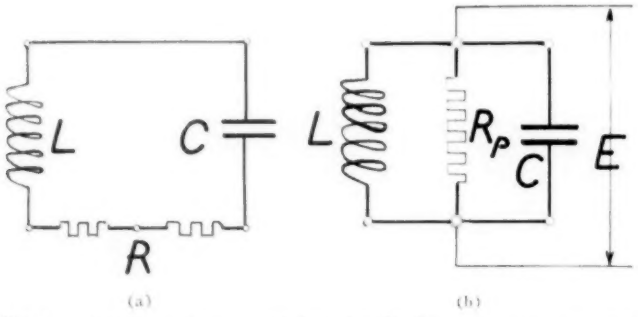

Fig. 1. — Oscillating circuit consisting of self induction L, capacity C, and loss resistance R; (b) The equivalent circuit to (a). The power less in the resistance Rp is E^2/Rp.

which impels a high frequency alternating current over the circuit, there will appear as a result of this flow of current across the loss resistance R consumption of power. This consumption is the product of the square of the current and the resistance (I^2R). It is evident that the so-called loss power presented in the formula can be produced also by a different resistance. If one conceives instead of the resistance Rs one in series with the coil and the condenser and parallel to the terminals A and B, one can find for any desired value of the resistance Rs such an equivalent parallel resistance Rp (fig. 1b) through which the tension at the terminals A-B pro-

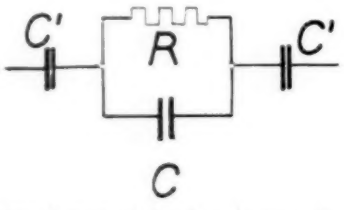

Fig. 2. — Equivalent diagram of the object between the electrodes. C = Capacity of object, R = loss resistance of object, and C' = spacing capacities.

duces a current whose consumption of energy is as large as the preceding one. Accordingly the same power loss may be formulated thus: E^2/Rp.

If the known phantom scheme utilized as an object of treatment is placed in the oscillatory circuit (fig. 2), and one recalls that power is used up only

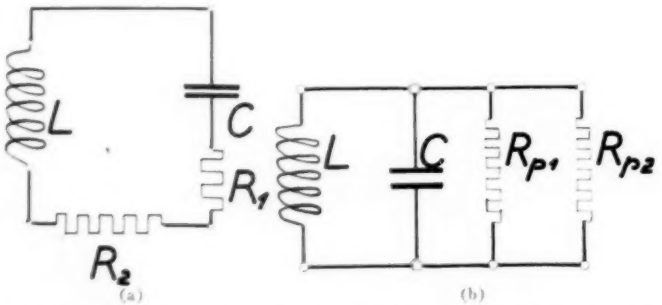

Fig. 3. — (a) The loss resistance of the object is substituted by a series of ohmic resistance R_2; (b) the loss resistance of the object is substituted by an ohmic parallel resistance R_{p_2}.

in the ohmic components of the phantom, it will be seen at a glance that one may select for a final diagram of the oscillating current including the object of treatment, either the one shown in figure 3a or the other in figure

3b. In either case the resistances with the index 1 show the loss resistance of the oscillating current itself, while those with the index 2 denote the equivalent loss resistance of the object under treatment.

From this point of view it is at once clear that the "equivalent loss resistance" of the treated object varies according to the position of the electrodes, for if we assume a constant tension at the electrodes their greater spacing carries a lesser part of the tension to the patient and the power consumed by him is diminished. In the instance of a large distance of the electrodes the "equivalent loss resistance" in the patient's circuit will have to be replaced by a larger parallel resistance R_2 in the diagram 3b, or by a smaller resistance in series in the same diagram.

It would lead us too far to enter into details of the physical and mathematical basis of the diverse methods of measurement. Interested readers will find them in my article soon be to published in the periodical *Elektrotechnik und Maschinenbau*, of Vienna. Here we will restrict ourselves to a presentation of the procedure of measurement.

Method of Measurement

If one excites an oscillatory circuit (fig. 4) by a small signal-generator

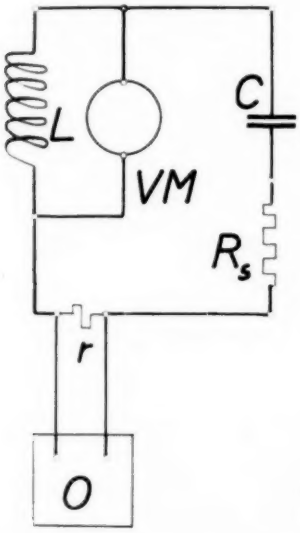

Fig. 4. — The deflection of the tube voltmeter Vm is proportional to the reciprocal value of the loss resistance Rs2.

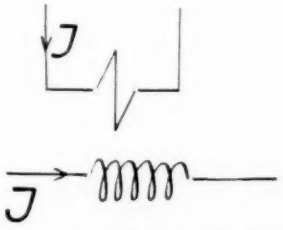

Fig. 5. — The deflection of a dynamometer instrument is proportional to the product of field coil current If and moving coil current Im.

in such a manner that the current of this transmitter flows through a small resistance (of about 0.01 ohm) and thereby produces a tension across it, there will be created at the resonance of the terminals A-B a tension proportional to the reciprocal value of the loss resistance in series. If the tension at the terminals A-B is measured with a tube voltmeter one obtains the deflection $\alpha_1 = K \frac{1}{R_1}$. If the patient is now placed between the electrodes there will be an increase of the series loss resistance of the circuit by the "equivalent patient resistance" R_2, as was shown above. If the deflection of the circuit developed through the increased capacity of the patient is again compensated by the condenser C, the deflection of the tube voltmeter α_2 will be proportionate to the formula $\frac{K}{R_1 + R_2}$. From these two measurements one can by simple calculation obtain the "equivalent pa-

tient resistance" as: $R_2 = \frac{\alpha_1 - \alpha_2}{\alpha_2} R_1$. (We will see later that with the new method this calculation is developed automatically through an adjustment of the appliance.) Accordingly the first datum we have obtained is the patient's resistance. As above mentioned, measurement of the current leads to erroneous results. For this reason we resort to measurement of the tension and transpose the finding of the "equivalent patient's resistance" as an equivalent parallel resistance visualized at the terminals for the connection of the electrodes. In order to determine the energy consumed in this equivalent parallel resistance, or, in other words, in our object under treatment, we must determine the formula E^2/R. This must be accomplished in such a manner that the determination is attained automatically by a registering device, which immediately shows the patient's energy. This procedure is achieved by use of a dynamometric instrument.

In such an instrument (fig. 5) which consists of a rotating coil and of a field coil, the excursion of the needle is proportionate to the product of both currents Id If. To carry out the measurement of the energy we allow a current to pass solely through the rotating coil of the dynamometric system, the current being proportionate to the square of the tension, while the current passing through the field coil is proportionate to the reciprocal resistance 1/Rp. A current proportionate to the square of the tension is obtained by measuring the tension at the electrodes (respectively a tension proportionate to it) with a thermocouple. At the direct current terminals of the thermocouple there arises a direct tension which on its part propels a current proportional to the square of the high frequency tension through the rotating coil of the dynamometer. To obtain the energy, the current in the field coil must be arranged by means of a regulating resistance and a constant source of a direct current in a manner to render the current proportionate to the reciprocal value of the "equivalent patient's resistance." Figure 6 diagrammatically illustrates this arrangement.

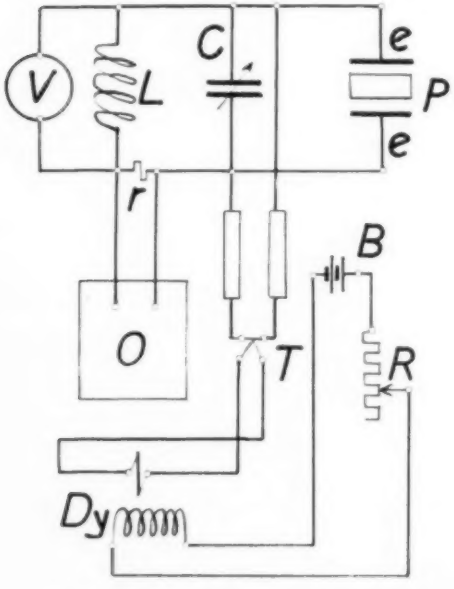

Fig. 6. — Schematic diagram of the patient circuit L, self-induction; C, capacity; e, electrodes of the patient circuit V; valve voltmeter; O, oscillator; T, thermocouple; Dy, dynamometer; P, object between electrodes; R, adjusting resistance of field current.

The practical construction of the appliance is accomplished on the above described basis, so that actual measurements may be accomplished by two

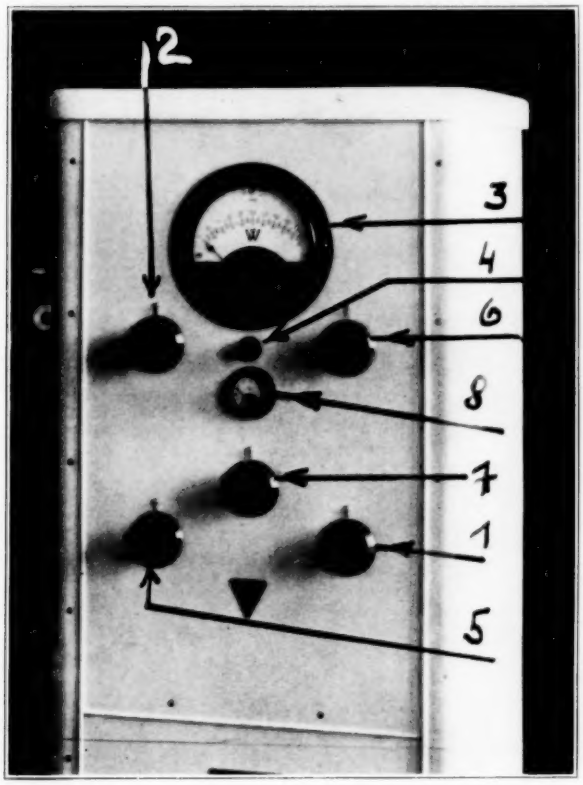

Fig. 7. — Front view of a 200 watt short wave therapy transmitter, with direct reading instrument for the control of the power absorbed in the object under treatment.

or three movements, part of which are automatic. Figure 7 illustrates a transmitter constructed according to my design by the firm Ing. Ludwig Schulmeister, Vienna, which has a built-in arrangement for energy dosimetry. We will see from the illustration that the manipulation of the appliance is simple.

First the desired electrode distance (spacing) is fixed and then the transmitter is switched (1) to the position for measuring, followed by tuning of the capacity by means of dial (2) to the maximum excursion of the meter (3). By slightly turning the small knob (4) this excursion is increased to the limit of the meter (3). Now the patient is placed between the electrodes and the circuit is again tuned to the extreme excursion of the needle in the meter (3) by turning dial (2). The meter (3) is provided with a double reading scale, the lower one being divided to correspond with the division on dial (5). This arrangement activates the regulating resistance of the field coil. The resistance is constructed and marked the same as the lower scale of the instrument so that by adjusting the corresponding values, that of the current in the field coil corresponding to the "equivalent patient's resistance" is set. If now switch (1) is turned to open the therapeutic apparatus proper, any desired energy between zero and 200 watts in the patient's circuit can be adjusted by turning dial (6) and immediately read off the scale on the meter (3). Dial (6) activates a regulating resistance in the primary circuit of the high tension transformer, by which the anodal tension of the therapeutic transmitter is regulated. Eventually to equalize variations of the primary voltage, use is made

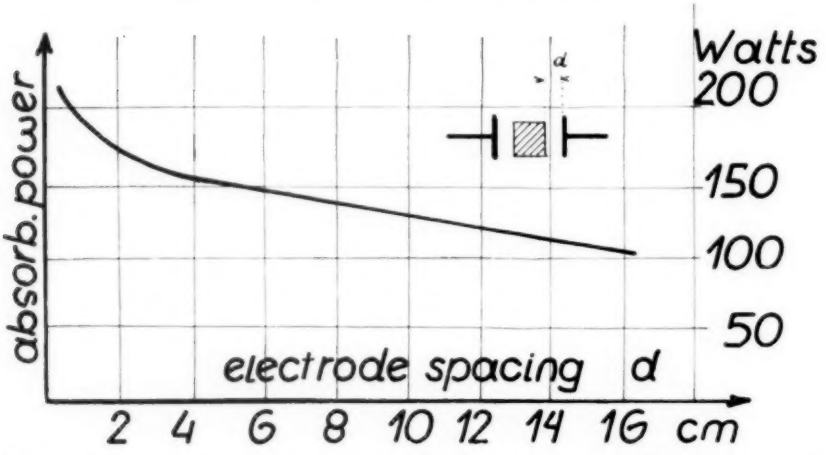

Fig. 8. — The power absorbed in the object as a function of the distance d/2 between electrodes and object.

of switch (7) which allows finest gradation of the primary tension of the entire equipment, the tension constant being regulated at the red mark of the small instrument (8).

Numerous measurements made on phantoms either calorimetrically or photowattmetrically absolutely confirm the theoretic postulates. The error of index in no instance exceeds 5 per cent. The reported measurements were made on a tube transmitter of 9 meter wavelength. With a suitable construction of the electrode cables allowing a compensation of capacity, this method is applicable also for wavelengths up to 4 meters, as was confirmed by actual tests.

In addition to these purely physical considerations we submit a few remarks on the medical use of the appliance and draw some conclusions from them. In an earlier publication which appeared in No. 38 (1935) of *Elektrotechnick und Maschinenbau*, it was shown by measurement with an indirect method that the maximum energy which patients receiving treatment of the thorax can tolerate for some time amounts to about 100 watts. These measurements have been confirmed by the new directly registering method. They are also in accord with those reported by Wenk at the International Short Wave Congress to the effect that patients can tolerate a treatment of the chest of about 140 watts for only a few seconds.

If one bears in mind these measurements and at the same time takes cognizance of the energy graph of a transmitter shown in figure 8, one gains a certain insight into the physical process in a biologic object, at least from the standpoint of energy exchange. One sees that in properly constructed apparatus (also smaller ones) it is possible to carry energies above 100 watts to the object under treatment even at decided distances. But at even more extended distances or at dosages designated in medical practice as "weak," the objects absorb energies of 30 watts, which still represent considerable values in relation to maximal dosage. We see that in patients whose subjective sense of heating no longer facilitates control, a reliable index of the absorbed energy affords exact control and the ability to repeat each individual treatment.

Conclusion

The method presented is sufficiently exact to enable the physician to determine typical energies for various diseases and in that way to arrive at a well founded method of short wave treatment.

RESEARCH METHODS AND PHYSICAL THERAPY *

HOWARD A. CARTER, B.S. in M.E.

Secretary, Council on Physical Therapy

American Medical Association

CHICAGO

Therapeutic and diagnostic apparatus utilizing physical forces as the active agents are considered by the Council on Physical Therapy. Admittance to the accepted list depends on their usefulness and on the methods of marketing, which must be in accordance with the Official Rules of the Council.* Briefly, the rules are: An apparatus to be eligible for acceptance must be efficient in its purpose; the advertising for it must not contain false, unwarranted, or misleading claims; and the marketing methods must be ethical. The Council never "approves" apparatus; it "accepts" them for inclusion in its official list. The Council makes no charge for the consideration.

After the Council has investigated a given appliance and reaches a decision, a report is prepared for publication in The Journal of the American Medical Association. This may be either an "acceptance" or "rejection." If the report is an acceptance, it is referred to the manufacturer for his information and for checking on possible errors. If a rejection, it is sent to the manufacturer, and he is given ample time to reply before the report is released for publication, provided the manufacturer has submitted the product.

The burden of proof for the physical and therapeutic efficacy of a device rests on the manufacturer. He is obliged to secure critical evidence to verify the physical and therapeutic claims made for the appliance, and he is expected to engage the best technical assistance available to make the investigation. The Council may and does, when necessary, make its own investigations.

When a product is presented for consideration, usually the first question asked is, "What evidence is available to substantiate the therapeutic claims made in the advertising matter and descriptive literature?" To assist the promotor in determining the requisites and qualifications of an investigator, a copy of the Council-adopted article "Evaluation of Methods Used in Physical Therapy" by Karsner and Goldblatt is given to him. He is informed that, in the final analysis, the success or failure of any form of therapy or therapeutic agent in the practice of medicine is appraised by its action on living patients. The evaluation of the treatment is not to be measured by the opinions of the physician but rather by the facts he can demonstrate.

An inexperienced manufacturer may inquire further concerning the necessary qualifications of a suitable investigator. He is told the Council believes that the investigator must be one who by training, experience, initiative, imagination, controlled curiosity, and intellectual honesty is qualified to undertake an objective examination of the matter in hand without preconceived ideas or prejudice. He must attack the problem calmly, deliberately, with a clear program based on a well thought out hypothesis, and must be thoroughly familiar with the work of others along the same and similar lines. These qualifications exclude at once the charlatan. More im-

* Read at the Fifteenth Annual Session of the American Congress of Physical Therapy, New York City, September 7, 1936.

*Copy may be obtained from the Secretary of the Council on Physical Therapy, 535 North Dearborn Street, Chicago.

portant still, it eliminates those who commonly report on the value of a form of treatment, or a therapeutic agent, without adequate knowledge of the method or physical agent employed. The Council demands definite proof of the accuracy of diagnosis of the condition treated, and a scientifically established demonstration of the value and accuracy of their conclusions by a comparison with control tests wisely chosen and properly performed.

An inventor submitting a product once remarked "My family physician used my machine in his practice and told me it was good for rheumatism." Another said, "I tried this instrument on my wife and mother-in-law for their arthritis, and they got well." Such statements are not evidence. Likewise, a testimonial dashed off by an enthusiastic physician does not constitute therapeutic evidence. Data submitted to the Council are examined not only by clinicians, but by physiologists, surgeons, dermatologists, bacteriologists, pathologists, radiologists, and physicists. Hence, clinical opinions and especially case reports are immediately under question by those scientists who demand controlled experiments to establish facts.

The Council suggests two methods by which acceptable therapeutic evidence may be accumulated.[1] The first is the statistical method in which alternate patients receive or do not receive the treatment. This method can only be of value when a large series of patients is available. Even then its value is limited or doubtful, because it cannot take sufficient account of the individuality of cases. The second method attempts to distinguish the effects of unknown therapeutic agents — the method that might be called the "comparative method" or the "blind test." For example, in the comparative method one series of patients is treated with the agent under consideration and another is treated similarly but with inactive agents, masked to be rendered indistinguishable by both the patient and the experimenter. When the experiment has run its course, the observer selects the improved patients from those showing no improvement and correlates the data. In the investigation of the effects of ultraviolet radiation, for example, this method may be used. One series of patients might be treated with radiations that are potent, and the other series with radiations that pass through a glass impermeable to the ultraviolet portion of the spectrum, although to the eye the source may resemble the potent one. The comparative method is desirable because it avoids favorable or unfavorable opinions of the observer, irrespective whether these opinions are gained consciously or otherwise.

Statistical Method

Owing to the limitations in the applicability of the comparative method, it is necessary in many instances to fall back upon the statistical system when investigating a therapeutic agent. This permits opinions on the part of observers, but the number of observations must be multiplied so as to decrease the factor of error. This can be practically eliminated by objective evaluation of effects without knowledge of the type of treatment used. Thus, one experimenter gives the treatment and another makes the observations on the patients without knowledge as to which have and which have not been treated. It is the most practical way that is likely to lead to logical, sound and probably correct conclusions. As an example of the value of the statistical procedure the following is cited: At an institution a group of patients, say sixty or more, having the same disease are selected as uniformly as possible. The group is separated into two divisions. Half of the number may be called the control group, while the other half is treated by the physical therapy method under consideration. The control group is treated by measures that have been established; the experimental group is

treated similarly except that the agent under consideration is used. One department of the institution makes the diagnosis and refers the cases for the physical therapeutic method to be investigated. After treatment the cases are referred back to the original department for evaluation. The influence of the physical therapists, therefore, is eliminated so far as any previously conceived opinion is concerned. If an appreciable benefit is shown in the group which received the treatment under question over and above the control group, it is reasonable to believe that there is an inherent value of the treatment. If there does not appear to be any appreciable improvement of one group over the other, it is proper to assume that the physical method in question possesses no unusual merit. In view of the fact that many patients may be benefited, if not cured in time by rest and intelligent management, the evaluation of physical therapeutic agents is often difficult.

The main essential of any experiment in therapy is that observations with a particular form of treatment must be properly controlled and checked. The number of observations must be large enough to minimize some of the disadvantages of random selection. If the person who conducts the experiment knows the nature of the method employed in each case, he must make his observations as objectively as possible.

Animal experimentation has been used in physical therapy, but this method is not developed to the high degree attained in drug experimentation. Moreover, when evidence is obtained on animals, the question is usually raised, "What will it do on human beings?" Therefore, the final test of the effects and value of a therapeutic measure designed for human beings is on the human patient.

The physician seeking information from the Council has a right to have the best that can be secured. He rightly feels that if there is any guessing to be done as to the merits of an apparatus, he can do it as well as anybody else. From the Council, however, he expects sound information and critical evidence gathered by the best possible methods and verified by outstanding men in the field.

Reference

1. Karsner, Howard T., and Goldblatt, Harry: Evaluation of Methods Used in Physical Therapy, J. A. M. A. **100**:1495 (May 13) 1933.

Meetings of Physical Therapy Organizations

In this permanent column will be published information about meetings, election of officers, etc., of physical therapy organizations. New data should be sent promptly to the office of the Secretary, Dr. Richard Kovács, 1100 Park Avenue, New York.

Academy of Physical Medicine. Annual Session, Hotel Walton, Philadelphia, October 19, 20, 21. Herman A. Osgood, M.D., Secretary, 144 Commonwealth Avenue, Boston.

Pacific Physical Therapy Association; meetings at Hollywood Hospital, Hollywood, Calif., fourth Wednesdays. Cora Smith King, M.D., Secretary, Hollywood Hospital.

Kings County Medical Society, Physical Therapy Section; meetings at 1313 Bedford Avenue, Brooklyn, bi-monthly on second Thursdays; Dr. H. T. Zankel, 5 St. Paul's Place, Brooklyn, Secretary.

International Society of Medical Hydrology. The next annual meeting will be held during the week of October 18-22 in Wiesbaden. Excursions will be made to Frankfurt, Bad Nauheim and other resorts. Write to Dr. F. Howard Humphris, 4, Great Stanhope St., Park Lane, W.1. London, England.

Pennsylvania Physical Therapy Association; meetings at the Philadelphia County Medical Society Building, third Thursdays from September to June; Dr. Arno L. Zack, 216 East Broad Street, Bethlehem, Pa., Secretary.

New England Physical Therapy Society; meetings at Boston on second Wednesdays from October to June; Dr. William McFee, 41 Bay State Road, Boston, Mass., Secretary.

New York Physical Therapy Society; meetings at the New York Academy of Medicine, on first Wednesdays from October to May; Dr. Madge C. L. McGuinness, 1211 Madison Avenue, New York, Secretary.

PHYSICAL THERAPY OF CHRONIC ATROPHIC ARTHRITIS *

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Chronic atrophic arthritis is a systemic disease characterized by varied and profound physiologic disturbances as well as inflammatory changes in the various joints. These changes begin in the synovial membrane, are proliferative in nature, and involve the periarticular tissue. As the disease progresses, the articular cartilage becomes destroyed and is replaced by fibrous tissue, which in turn becomes calcified and results in bony ankylosis of the joints.

The exact etiology of the disease is unknown. It affects all classes and ages of humanity and is found in all parts of the world, although the incidence is greater in cold, damp climates. It occurs most frequently between youth and middle life, and is more prevalent in women than in men. Malnutrition, environment, over-work, worry, strain, trauma, have some influence, but chronic foci of infection play the most prominent role.

The onset of the disease may be sudden, accompanied by chills and fever, or it may come on gradually with little or no change in temperature. Swelling and abnormal collections of synovial fluid may or may not be present. Pain, especially of the affected joint, is a constant and dominant symptom. Associated with the pain is spasm of the muscle groups above and below the affected joint, which possibly has the effect of a protective mechanism to relieve the pain by immobilizing the joint. As the muscle spasm becomes prolonged, the stronger flexor groups overcome the pull of the weaker extensor groups, thus producing the flexion deformities, characteristic of chronic atrophic arthritis. Atrophy of the weaker groups occurs early. It is an atrophy of disuse and as it progresses, the stronger flexor groups become more contracted and produce a characteristic tendon shortening. At the same time there is a tendency of the posterior capsule of the joint to become thickened, interfering with the normal extension of the joint. Also, there is a marked decalcification of the cancelous ends of the articulating bones, adding to the complexity of the disease. Thus we have several factors which, acting in conjunction with the inflammatory changes within the joint itself, greatly interfere with the normal function of the joints and aid in production of characteristic deformities and faulty body mechanics.

The pathologic changes in the joints are so interrelated with the physiologic disturbances that it is extremely difficult to differentiate between cause and effect. Certainly there is established a viscious cycle which renders chronic atrophic arthritis the most difficult of all human ailments to treat.

It is perhaps appropriate to point out that with the development of the deformities and faulty body mechanics, profound physiologic disturbances not only have added to the complexity of the disease but also have produced confusion as to its etiology. There is a generalized loss of body

* Read at the Fifteenth Annual Session of the American Congress of Physical Therapy, New York City, September 11, 1936.

tone and metabolism is slowed. Digestive disturbances, such as achylia, constipation, circulatory disturbances and impaired secretory functions are a part of this picture. Any of these physiologic disturbances may be a symptom of some chronic condition that could be the cause of the disease. The condition is further obscured by the fact that these same disturbances may be the result of faulty body mechanics.

Treatment

Since we know that the etiology is influenced by a variety of factors, that we are dealing not only with joint disease but with profound physiologic changes as well, and that it is often impossible to differentiate these disturbances from cause and effect, it is obvious that no single therapeutic measure can accomplish a cure. It is easy to understand why confusion exists concerning the treatment of chronic atrophic arthritis. Each case represents a separate problem requiring a broad, well organized and individualized plan of management. The successful application of this plan requires time and intelligent cooperation of the patient. Sudden dramatic cure is the exception; slow gradual improvement is the rule.

The treatment may be classified as medical, orthopedic, and physical therapeutic, and these should be conducted simultaneously without overemphasizing any one of the three. Within recent years, however, physical therapy has assumed a special importance in a well organized, scientifically applied regime in chronic atrophic arthritis.

Apart from sunlight, the fundamentals of physical therapy consist of heat, exercise, and massage. Their proper application produces definite physiologic effects commonly unattainable by drugs, which greatly benefit the chronic arthritic patient. This is true not only from the standpoint of treating the joint proper but also as an aid in the correction of associated physiologic disturbances.

While there are numerous recognized physical methods of treatment, it has been demonstrated that hot water has decided mechanical advantages in increasing the effectiveness and simplifying the application of heat to the body.

Hot Baths

By immersing the body in hot water, an even bodily temperature can be obtained which can be lowered or raised to secure the effect desired. The bath is started at a temperature of between 96 and 98, gradually increased to 99 to 100 degrees F., or even more if desired. While the patient is placed in the tub, general friction with a rough mat is instituted by the attendant. The time of the bath depends on individual tolerance, and usually lasts from 20 to 30 minutes. Upon removal from the tub the patient is placed in a vapor cabinet for 3 to 10 minutes, after which he enters a pack room at a temperature of 115 degrees F. Here hot packs are applied to the affected joints. These packs are changed two or three times in a period of 15 to 30 minutes. The patient then goes from the pack room to the cooling room, where he is gradually cooled and given a tepid shower, followed by very light massage and an alcohol rub. Baths should be taken on an empty stomach, the bowels should be kept working properly, and at least one-half gallon of water should be taken in a 24 hour period. In our work we have found cold mineral water a valuable adjunct to the treatment, as the mineral properties of the water aid in maintaining the alkaline balance of the body. Then, too, larger quantities than of any other water, can be tolerated.

Physiologic effects obtained by this procedure are very beneficial to the arthritic patient. There is produced marked peripheral vasodilatation, evidenced by pronounced redness of the skin and a drop in the blood pressure. The blood is assumed to be drawn from the deeper congested areas to the surface of the body. There is a decided increase in the rate of the blood flow, manifested by acceleration of the pulse rate and increase of the respiratory rate. Metabolism is stepped up. The hot packs to the joints greatly facilitate the breaking down and the excretion of the inflammatory products.

Therapeutic Exercise

The program of exercise is directed toward the prevention and correction of deformity, the reeducation of atrophied muscle groups and the restoration of normal body mechanics. The type of exercise depends entirely upon the needs of the individual patient. A routine set of exercises can be fitted to group needs. The administration of the exercises in a pool of hot water greatly increases their effectiveness, and the buoyancy of the water permits certain mechanical advantages which enhance the effieiency of the exercises.

Buoyancy is a force acting in opposition to the pull of gravity and is equal to the weight of the water displaced by the immersed body. Therefore, by immersing a chronic arthritic patient in water, one is able to obtain relatively free movement in all planes, with a minimum amount of effort by, and pain to, the patient. This affords the operator better control, to the extent that muscle spasm and interarticular tension are lessened. The arc of motion is increased without pain to the affected joint, which further enlarges the effective range of the exercise.

The buoyancy of the water, moreover, aids the application of exercise in that it permits a more accurate exercise dosage to atrophied, weakened muscles, with a minimum amount of motion in the opposing groups. With these fundamental facts in mind, one may readily understand that exercise, otherwise impossible to perform, is carried out with comparative ease under water. For example, patients with marked flexion deformities of the knees walk in water, while out of water each step is a painful, burdensome task. The amount of passive motion is decreased, which further aids the effectiveness of the exercise.

By giving therapeutic exercise in water at a temperature of 98 to 99 degrees F., continuous hyperemia is maintained during the actual time of movement. This aids the buoyancy of the water in producing a general relaxation, decreasing muscle spasm, and increasing the arc of motion of an affected joint without pain. The temperature is sufficient to produce marked peripheral capillary dilatation. This increases the flow of the blood and lymph to the parts, stimulates the nutrition of muscular tissue, and promotes the elimination of toxic waste material At the same time this temperature is insufficient to produce a stimulation of the central nervous system. The heating effect obtained during the time the muscle is working greatly increases the amount of its work without becoming fatigued. In addition continuous capillary dilatation during the actual time of muscle movement greatly facilitates the breaking down and excretion of organized inflammatory exudates in and around the muscles and joints. This method of applying heat during the time of exercise is obviously superior to that of superficial heating followed by exercise. The hyperemia produced by dry heat is not constant, the part cooling as the exercise progresses. There is a consequent capillary contraction and retention of toxic waste material with the exercise dosage reduced due to fatigue.

Underwater Massage

The effectiveness of underwater exercise is further enhanced by underwater massage and by stretching of contracted muscles and ligaments. Light stroking is started as soon as a hyperemia is attained. This stroking is confined to the muscle groups above and below the affected joint, and after a relaxation is obtained, heavier reverse stroking is started on the contracted groups. Gentle traction is then begun and gradually increased to the point of pain. Stretching is done very slowly but firmly, many contractures being overcome that would otherwise require operative intervention.

Gentle deep kneading massage, under water, is then instituted. The physiologic effect is greatly increased, due to the continuous hyperemia produced by the heat of the water. Following the massage the exercise program is started and pushed to the point of tolerance, that is, short of pain and fatigue.

Continuous peripheral capillary dilatation and generalized interchange of blood from the deeper congested areas to the surface of the body are effected. The pulse and respiratory rates are slight increased. There is a lowering of the blood pressure and a rise of temperature of one to two degrees. These changes persist as long as four hours after treatment. Following the treatment the patient feels relaxed and desirous of sleep.

The relatively free movement without pain and the performance of exercises in water, impossible to accomplish out of water, give the patient a pleasurable sense of activity. This is appreciated only by one who has been confined to bed or the wheel chair. Courage and confidence are restored. The patient becomes anxious to try new movements and looks forward to the pool treatment. An optimistic mental attitude is developed which is a material aid in any chronic disease.

In evaluating this physical therapy program as outlined, a number of factors must be considered. The Spa or institutional management is necessarily limited and unless proper cooperation from the home physician is obtained, a successful outcome is doubtful. Too often someone's pet vaccine, "shot" or mechanical appliance is offered as a specific cure, and the beneficial effects obtained from the Spa or institutional management are wasted. Early diagnosis and the application of a proper physical therapy program are essential to the successful management of chronic atrophic arthritis. There are too few spas and institutions in America specializing in this branch of medicine, and as yet too few physicians who recognize and understand the value of physical therapy as outlined.

The Hot Springs National Park Spa, in Arkansas, is owned and controlled by the United States Government under the supervision of the Department of the Interior and the administration of the National Park Service. Its natural resources for the past hundred years have been dedicated to the use of American citizens. They are offered to the medical profession of America in the hope that these facilities will be taken advantage of to the fullest extent for a widespread, chronic, disabling disease taking an enormous toll annually.

Conclusion

A discussion of the current literature on atrophic arthritis has been omitted, as the concept of the disease and the importance of the physical therapy program as outlined are generally accepted. Hot water for the application of heat, exercise and massage in chronic atrophic arthritis is advocated. The physiologic effects obtained by this method have been outlined. A plea is made for a better understanding of the basic principles

of physical therapy and for a closer cooperation of the medical profession with the institutions and spas of America, specializing in this branch of medicine.

236 Central Avenue.

(For discussions please turn to page 682)

POSTURAL DEFECTS RELATED TO ARTHRITIS *

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NEW YORK

Defects in bodily posture affect patients with arthritis in five ways. (1) Poor posture is a mechanically inefficient carriage and therefore requires an undue amount of energy in standing and sitting. In this way it adds one more burden to the already overburdened constitutional inadequacy of these patients. (2) It produces ptosis of the gastro-intestinal tract and decreases the vital capacity of the lungs. This embarrasses the normal function of these organs. (3) It predisposes to lower back pains. (4) It causes undue trauma at certain joints, predisposing these to the localization of arthritis. In osteoarthritis, where the process is generalized, this static trauma localizes the development of pain in certain crucial areas such as in the lumbo-sacral and cervical spine, the knees and the feet. (5) It has a depressing psychologic effect.

It is important in these days not to revive the mechanical school of physiology of Goldthwaite. Also it is important not to develop a totalitarian viewpoint in relation to posture; to blame all bodily ills on postural defects and to claim remarkable results by their correction in all the fields of medicine. However, it is commonly accepted that chronic arthritis is a constitutional disease and until we have a clear idea of its etiology, the most effective treatment must be directed toward the various constitutional derangements presented by these patients. My objective in this discussion is to emphasize some of the salient characteristics of good and bad posture, the correction of the latter, and to point out how these ideas can be put to practical use in clinical and private practice.

I cannot overemphasize the role of weak feet in the causation and correction of poor posture. However I will leave consideration of this subject to the orthopedist, with whom it properly belongs.

Evolution and Mechanics of Posture

It is important to remember that the erect carriage is characteristic of man alone. It is interesting and instructive to study the evolution of the erect carriage. Our amphibian and reptile ancestors did not attain erectness through gradual stages from the horizontal to the perpendicular. The ancestral line from which man evolved first took to the trees and led a brachiating existence. This hanging from the limbs of trees determined to a large extent man's subsequent make-up. It developed the marvelous facility of circumduction at the shoulder joint. Gravity gradually extended the lower limbs at the thighs and knees. Subsequently our aboriginal an-

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cestors dropped to the ground. The most marked effect of this was on the spinal column. While in the past the spinal column acted merely as a tractile support, now it became the supporting column. There were four anterior components of force applying stress to this column — the head, upper extremities, thorax and abdomen. Naturally the spinal column developed a concavity forward at its upper extremity and thus we have the normal dorsal kyphosis. To counteract this there developed a thrust forward in the lumbar area, giving us the normal lumbar lordosis. It is interesting to note, that the gorilla, the animal nearest to man in the evolutionary scale, is the only one that has a lumbar lordosis.

Most postural defects are the result of an exaggeration of this lumbar lordosis, associated with which is a forward tilt of the pelvis. In good posture, and this excludes most young men entering college, a plumb line dropped from the mastoid process will bisect the tip of the shoulder and the hip joint, and will fall somewhat anterior to the center of the knee joint. It will lie in the plane of the scaphoid bones of the feet. The back will be straight, the knees slightly hyperextended. There will be no evidences of weak feet. In poor posture the head is held forward, there is an exaggeration of the dorsal kyphosis, the chest is depressed, the inclination of the ribs is increased. There is an exaggeration of the lumbar lordosis, the pelvis is tilted downward, the abdomen protrudes. The knees may be markedly hyperextended. In our opinion the key to many of these postural defects is the exaggeration of the lumbar lordosis, and treatment should be directed mainly at its correction.

The question of posture is, in its final analysis, a mechanical problem involving an upright object subjected to the pull of gravity. If one attempts to lift a heavy pole from the horizontal to an upright position, great force is needed until the pole is perpendicular, at which time a minimum of energy will support it. So with man. Once he was destined in the evolutionary process to stand erect, he submitted himself, compared with the other animals, as the quadrupeds, to a disadvantage in relation to gravity. He must stand completely erect. If he goes half-way he pays the penalty in unnecessary expenditure of energy.

Correct Posture

In correcting posture the first question to decide is our concept of normal posture. Good posture certainly is not average posture because at least 70 per cent of healthy young adults deviate from the accepted ideal. It is better to discard the expression "normal posture" and confine ourselves to the terms "good posture" and "bad posture" in varying degrees. This greatly simplifies the problem, for we are then dealing merely with the question as to whether the particular posture under consideration is mechanically efficient. I believe it can be proved, and have attempted to demonstrate in the Exhibit of this Congress, that the erect posture is mechanically the most efficient and therefore its maintainance requires the least amount of muscular effort. Such conservation of effort is of paramount importance to any patient with rheumatoid arthritis since his vitality is already at a low ebb.

There is no question that the erect posture raises the position of the gastro-intestinal tract in the abdominal cavity. The exact mechanism by which it does this is somewhat obscure. It may be, as others have pointed out, that the gastro-intestinal tract, through its attachments to the diaphragm, to the anterior pericardial ligaments and through these to the cervical vertebrae is raised when the spine extends to its maximum height. At any rate it can be demonstrated that a shift from poor posture to good raises the

gastro-intestinal tract from 2 to 4 inches. One may assume that this enhances the drainage of the gastro-intestinal tract.

This is not the place to discuss the syndrome visceroptosis. It has been shown that many people have stomachs and colons low in the pelvis with no digestive symptoms whatever. On the other hand many of the so-called chronic intestinal invalids have organs placed high in the abdominal cavity. At present it seems that the least important feature of the clinical syndrome is the visceroptosis itself. I think it can be proved, however, that a decrease in the angulation as the food passes from the stomach to the duodenum, and lessening of the redundancy of the colon, promote the efficiency of the gastro-intestinal function.

Results of Defective Posture

Poor posture predisposes to and sometimes causes low back pain. The subject of low back pain is a complicated and disputed one. Back pain is a symptom and, as with headache, the detection of its cause requires the utmost skill of the diagnostician. It is an every-day problem to the general practitioner and one of the most common complaints of patients as they present themselves in our arthritis clinics. Its causes are almost infinite.

The conditions in the spine and related structures which must be considered are: (1) congenital anomalies, (2) traumatic disturbances, (3) rheumatic and arthritic manifestations, (4) poor body mechanics, and, (5) most important of all, a combination of these causes. The point to be emphasized is that all these causes are important, but that most of them would not cause symptoms were it not for the superimposed development of trauma, or of the static trauma of bad posture. It is essential when seeing a patient with backache to know if congenital anomalies exist, but one is usually prone, on taking an x-ray film and finding a sacralization of the 5th lumbar, to say, "Ah, there is the cause of the backache," forgetting that the patient has carried the anomaly through life and was symptom-free until we see him at, let us say, the age of 35. What excites the symptoms? The answer is usually trauma and, more important still, the static trauma of poor posture.

Direct traumatic causes are common but it is our conviction that a back habitually maintained in poor posture is much more susceptible to injury from dynamic trauma than a back habitually maintained in a mechanically efficient way.

Rheumatic and arthritic manifestations are of great importance as a cause of low back pain especially in elderly people. In rheumatoid arthritis seen in the young adult, low back pain is not commonly an important factor. In osteoarthritis of middle and later life, however, low back pain is one of the most prominent symptoms. Lipping is most common in the lumbar area. Here again the pathologic process revealed by the x-ray must be accepted as the cause of low back pain only with the greatest caution. Lipping is universal after 50 and in most instances gives no symptoms. Static trauma is often the localizing cause of pain.

The effect of posture in localizing the symptoms in arthritis is most important in osteoarthritis patients. The osteoarthritic group manifests a tendency to increased horizontal measurements as compared with a group of rheumatoid patients. Individuals of the osteoarthritic group have shorter, thicker necks. Their silhouette is more massive than slender, their chest circumference in relation to that of the abdomen is greater. They have a tendency to be over-weight. Their posture is almost universally bad, characterized by an increase in the curvature at the cervicodorsal junction, an

increase in the lumbar lordosis and a protruding, pendulous abdomen. This poor posture, together with the obesity and weak feet so commonly seen in these patients, puts undue strain at the cervical and lumbo-sacral areas of the spine and at the knees and feet. It is in these places that most patients are apt to localize their symptoms.

The depressing psychologic effect of bad posture must be obvious to everyone who has given thought to the subject. The erect posture keeps up the spirits and tends to banish despondency and depressing thoughts. This consideration cannot be over-emphasized in such a discouraging disease as rheumatoid arthritis. Bodily posture definitely influences the emotions. Many words in common use in speech testify to the varied connotations of correct posture. Among these might be mentioned "uprightness," "poise," "well-balanced," "level-headed," "back-boned" and "chesty." Conversely, the words "stooping," slumping," "round-shouldered," suggest ill-health, inadequacy, discouragement and defeat.

Methods of Correction

Enumeration of the details of the methods by which postural defects are corrected would require a great deal of space. There are two points I wish to emphasize. Muscular exercise in itself unless properly planned will not correct postural defects. Many people with a well developed musculature have poor posture from the mechanical point of view. Chamberlain,[1] for example, observed an athlete who trained himself until he could sit up from the reclining position 300 times in succession without resting, and failed to find any upward move of the greater curvature of the stomach resulting from this abdominal muscle development.

The second point is that the keystone of defective posture is often a lumbar lordosis and the associated pelvic tilt. Instruction to the patient to hold his head up, throw his shoulders back or "suck in his belly" will not touch the fundamental problem. To correct lumbar lordosis emphasis is placed not on exercises alone, but on developing a conscious control especially of the gluteal and abdominal muscles. This localized control enables the individual to hold the pelvis in its normal position. Without gaining this neuro-muscular control no amount of exercise will bring about satisfactory improvement in posture.

115 East 61st Street.

Reference

1. Chamberlain, W. E.; Moody, R. O., and Van Nuys, R. G.: Studies of Stomach, Liver and Colon: Results of Roentgenologic Studies of 600 Healthy Adults, J. A. M. A. **81**:1924 (Dec. 8) 1923.

(For discussions please turn to page 632)

CHRONIC ARTHRITIS OF THE SPINE: ITS RELATION TO RHEUMATOID DISORDERS

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Chronic arthritis of the spine lends itself to the same classification as arthritis anywhere else in the body. Two major types are recognized — the atrophic and the hypertrophic. Spondylose rhizomelique of the Strümpell-Marie type is regarded by many as a manifestation of the atrophic variety, as are also the arthritides of specific bacterial origin, such as tuberculous, gonococcal and thyphoid spondylytis. In this latter group the infecting organism induces changes in the joint structure comparable to those usually associated with arthritis of non-specific origin. This discussion will not concern itself with spondylose rhizomelique or with spondylitis due to specific bacteria.

Efforts to differentiate between the atrophic and the hypertrophic or osteoarthritic type of non-specific spinal arthritis are not often entirely successful. Both varieties are characterized by destruction of the inter-vertebral disc, calcification of the spinal ligaments and exostoses on the vertebral margins. On the roentgenogram the corresponding findings are narrowing of the inter-vertebral space, calcareous deposits in the intra-spinous legaments, lipping of the vertebral margins and, in the more advanced cases, true bony union of adjacent vertebrae. While one of the major points in the differential diagnosis between atrophic and hypertrophic arthritis is that in the latter true bony union never occurs, the spine is an exception to this rule, so that this feature is of no assistance in the differentiation of the two types. Changes in the density of the bone as seen on the roentgenogram are not a constant finding, at least not early in the disease, and offer very little if any assistance in distinguishing between the two varieties. In most cases with subsequent involvement of other joints, the type of arthritis present in the spine will become evident only when characteristic changes have developed in the articulations of the extremities.

Misinterpretation of Early Symptoms

The early symptoms of arthritic involvement of the spine are likely to be insignificant and are frequently overlooked or misinterpreted. While tenderness of the spine itself is usually lacking, referred pain is almost invariably present at some stage of the disease. The character and distribution of the pain varies according to the segment of the spine involved and the nature of the tissue affected. Involvement of the articular and periarticular structures may produce some tenderness at the site of the disease. As the inflammatory process extends to the adjacent muscles, symptoms indicative of myositis or fibrositis are likely to be more prominent. It is believed that the involvement of the muscles and fibrous tissue is due to the direct extension of the inflammatory process from the primary area by the blood and lymph vessels as well as along the nerve sheaths.

Involvement of the nerve roots produces pain and symptoms characteristic of neuritis or radiculitis. The distribution of the pain depends upon which nerves are affected. In the cervical region, the pain may be referred

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to the shoulder and arm or along any of the branches of the cervical plexus. In the dorsal region the pain is usually referred along the inter-costal nerves. In this locality and particularly if the pain is unilateral and on the left side it is often incorrectly diagnosed as cardiac disease. In the lumbar region the pain is likely to be referred to the kidney, groin or genitals, and in the sacral region the pain is referred to the hip and down the leg and is likely to be mistaken for sacro-iliac disease or as sciatica.

These various sydromes are generally called the rheumatoid disorders. Since they very frequently precede the onset of arthritis, they are said to represent the pre-arthritic state. Sometimes they are spoken of collectively as non-articular rheumatism. That these disorders represent the existence of an arthritic condition has not been sufficiently stressed, probably because during this stage of the disease, the symptoms respond to palliative measures and remissions are frequent. However, a more general recognition of the fact that these symptoms are definitely of arthritic origin and indicate the necessity of arthritic treatment on a broad plan will, in many cases, lead to a more certain cure, or at least prevent the extension of the arthritic process.

Symptoms of neuritis, radiculitis, fibrositis or myositis should always indicate the necessity of x-ray examination of the spine for arthritic involvement. The findings of abnormalities characteristic of arthritis associated with radicular or muscular disturbance may in most cases be accepted as indicative of the arthritic nature of the trouble. Frequently other evidences of constitutional derangements encountered in arthritis may also be present. Fatigue, increased sedimentation rate and focal infection are commonly seen. In the presence of these findings even though bony changes are not visible in the film, the diagnosis of spinal arthritis must be considered. It must be remembered that the destruction of cartilage and subsequent calcification of the soft tissues is an exceedingly slow process and may not have reached a point where it is discernible on the x-ray plate. Sometimes this process takes months or even years.

The presence of exostoses of the vertebrae is very common. Schmorl has found them in 93 per cent of patients past sixty. That these individuals are comparatively symptom-free is held by many to indicate that vertebral exostoses are of no significance. It must be remembered, however, that many in the sixth decade have exostoses on the joints of the extremities which are definitely due to hypertrophic arthritis, yet who never had any symptoms or discomfort. It would seem wrong, however, to conclude that because of their frequent occurrence these exotoses are physiologic and of no consequence. By the same reasoning it seems logical to regard bony or joint changes in the spine, be they ever so slight, as an abnormal finding. Their frequent association with neuritis, myositis and fibrositis would tend to establish the arthritic nature of the syndrome.

In most cases of generalized arthritis, both of the atrophic and hypertrophic types, it is astonishing to note the great frequency with which non-articular pain is given as an early symptom. In practically every case the patient gives a history of having had, at one time or another, recurrent attacks of indisposition which could be described as lumbago, sciatica, neuritis or some of the other rheumatoid disorders. The fact that in later years many of these patients develop definite arthritis would tend to support the belief that these syndromes are in reality forerunners or actually early symptoms of arthritis. That in many of these cases recognizable arthritic changes have already developed in the spinal column lends further support to this belief.

Preventive Treatment

It is not within the scope of this communication to discuss the treatment of arthritis. Nevertheless, our experience with cases of this type has led us to the conviction that the institution of measures of recognized usefulness for arthritis will in many instances prevent the extension and progress of the arthritic process. While physical therapy is an extremely important part of any well organized plan of treatment for arthritis, due attention must be given to the eradication of infective foci, the proper use of vaccine, dietary regulation, the correction of faulty elimination and of bad living habits. In arthritis of the spine particular attention should be paid to counteracting postural faults and static disturbances and deformities not only in the spine, but also in the extremities. Corrective exercises are an extremely important part of the treatment. Diathermy and other heat producing measures are a valuable adjunct, but must be regarded as entirely palliative. They should be applied to the involved segment of the spine rather than to the peripheral seat of the pain.

Summary

Our concept of chronic arthritis of the spine and its relation to the so-called rheumatoid disorders emphasizes the following points:

1. Despite their frequency, bony changes of an arthritic nature occurring in the spine are abnormal and indicative of disease.

2. The almost constant association of symptoms of neuritis, fibrositis or myositis with arthritic changes in the spine supports the conviction that these conditions are closely related and probably a part of the arthritic picture.

3. The frequency with which generalized arthritis is preceded by rheumatoid disturbances suggests the advisability of regarding them as forerunners or early symptoms of arthritis.

4. The prompt institution of treatment for arthritis in cases with rheumatoid symptoms, especially if associated with arthritic changes in the spine, offers probably the best chance of successfully preventing progression of the arthritis.

902 Medical Arts Building.

Discussions of Papers by Drs. Smith, Hartung and Lautman

Dr. William T. Johnson (Philadelphia): Anyone interested in physical therapy will find opportunity to use all of the measures already outlined and possibly some additional ones in handling various types of arthritis. In India, in some of the upper classes, there is in vogue a very unique system of exercises of all joints throughout their normal range. There are authors who believe that the failure to exercise the normal joint throughout its full range may be a very large factor in making it a vulnerable point for the development of arthritis. I throw that hint out for what it may be worth.

To eliminate inflammatory products it would be well to give an occasional autocondensation treatment. Autocondensation is somewhat in the discard at the present time, but enough studies were made years ago to show that it enhances elimination. In various forms of neuritis the painful areas exhibit a lessening of surface temperature. Just how deeply that goes I do not know, but when the pain is relieved the surface temperature returns to normal. It seems logical to assume that such a condition might exist also in arthritis and that, therefore, there is another reason for heat being indicated in its treatment.

The application of hot water, of course, is almost ideal. Undoubtedly we can get good results by applying heat in other ways, but this is apt to be overdone. The most useful physiologic results from the application of heat occur at temperatures within normal fever ranges. When we increase the heat, as can be done by diathermy and short wave, we can reach an effect beyond the best physiologic responses. To remove products of exudation from about a joint, we have a means in static electricity that is not as widely employed as it should be. We have much clinical evidence that areas of congestion can be promptly depleted by static discharge, the static wave, or the static sparks. I believe that in the joints there is a great

deal of exudation that is not yet organized, and in addition to heat we will get far more additional benefit by the application of static currents.

Dr. Charles Murray Gratz (New York): I believe that we should draw a very clear line between symptomatic treatment in arthritis and efforts to find the cause of the condition. The paper of Dr. Euclid Smith, the work from Hot Springs, and also from our own spa in Saratoga, has not received the proper attention and support from the medical profession. We must admit at the present time that we are far behind the European countries with the result that there is no coordination in the treatment and the people drift to European spas. I think we should patronize home industries and keep these patients in our own country. With us it is by no means a case of not having the facilities. Nor is it a matter of these facilities being in the hands of charlatans. They are all controlled by the various governments because for thousands of years people have realized that certain types of water and hydrotherapy are of benefit. If we, too, could get a little more cooperation between the various groups in one of the biggest problems we have, it would be better for all concerned and particularly for the patients.

There are two phases of this work which I do not believe have received enough attention. The first is that the skin is one of the greatest systems of elimination of toxins from the body. In the large majority of these cases we find defects in the elimination from the intestines and from the genito-urinary system. If patients would be as conscious of their skin as they are of their face or their hands, we would probably be able to better exploit it for helping the overloaded gastro-intestinal tract and the genito-urinary system to afford symptomatic relief.

The valuable work of Euclid Smith in under-water exercises is sound from every standpoint because we want motion, but we do not want to hurt the damaged joints. When one uses water to take the weight of gravity off the patient one has the ideal situation.

I do not believe that we make as full use as is possible of our modern plumbing facilities. I have my patients spend three-quarters of an hour a day, either under a shower or in a bathtub. They can do it themselves and if they cannot go to Hot Springs or Saratoga they can get at least some benefit of hydrotherapy right at home.

Dr. Samuel Ralph (Brooklyn): While we are in the dark about the cause of chronic arthritis, we know that the great changes that occur in the affected joints are expressions of, or reactions to either some infection or irritant in the body, or perhaps a glandular disturbance in the body with resultant disruption of salt metabolism. Underlying it all we have an individual whose resistance is low and who was perhaps exposed to dampness or to a low, humid climate.

When these patients come to us we are confronted with the end results of this condition. We see an individual weak, anemic, depressed and almost hopeless; with joints stiff, swollen and painful, with barely any motion in them.

The remedies suggested and tried are legion. To name only a few: Massage, rest, heat, diathermy, galvanism, vaccines, foreign protein and hydrotherapy. It illustrates the baffling condition which the practitioner confronts in chronic arthritis.

It is evident that each case must be studied individually and the proper remedy or remedies tried out. One must never forget to treat the individual as a whole. There is such a thing as improving resistance by removing any obvious foci of infection, attention to diet, elimination or change of climate.

Locally our attention must be directed to improving the circulation of the joints and to restore as far as we are able a normal physiologic function. Rest, combined with well directed exercise, massage and hydrotherapy are of very great value. The last named treatment is admirably described by Dr. Smith.

The fact that the patient is receiving a definite form of treatment directed by trained minds and administered by capable hands, gives him or her a new hope to combat the disease, as is evidenced by willingness to cooperate.

The underwater treatment should receive more general recognition because we have here something which is more than a single remedy. One has heat, water, massage and exercise. Add to this the routine care of the patient, such as diet, rest, elimination and general toning, and we are in possession of a combination of treatments which we can highly recommend to these sufferers and afford them not only relief, but in many instances also permanent improvement.

One word about prevention. So very little stress is laid on this phase of the care of the arthritic. If a system of education paralleling the ones carried on against tuberculosis and cancer were to be inaugurated against arthritis, and patients were to be taught to secure consultation and relief in proper time, a great deal could be accomplished in staying the suffering and helplessness associated with this disease.

Dr. John P. Stump (New York): Dr. Lautman's statement that all bone changes occurring in the spine are pathologic in nature, and can in no way be considered physiologic is very valuable. However his paper connotes that radiating pains are frequently due to exostoses causing pressure on nerve roots. In my experience this has not been the usual finding, the radiating pains are most frequently due to actual soft tissue inflammation, and not to nerve root pressure.

As Dr. Lautman emphasizes, and as I emphasized in a paper published several years ago, if the family physician can be

made to realize that the large group of symptoms so often diagnosed as neuritis, myositis, sciatica, and so on are the warning forerunners of oncoming arthritis, and if adequate treatment would be instituted in these early stages, great strides could be made in the treatment and prevention of the arthritic state.

It is regrettable that Dr. Lautman does not see fit to include Strumpell-Marie's disease in chronic arthritis of the spine. I feel it is more advisable to follow Dawson, and consider Strümpell-Marie's disease as rheumatoid spondylitis. Certainly from an orthopedic point of view Strumpell-Marie spine must be included, because it is this type of spinal arthritis which leads to the most severe and disabling deformities.

Dr. Smith is to be commended on his presentation of the fundamentally sound principles of the use of physical therapy in the treatment of chronic atrophic arthritis. Just as Gaenslen reminded us in his presidential address before the American Orthopedic Association, active motion is the primary factor in the development of muscle tissue and the improvement of muscle tone. We all know that only by adequate muscle power can the patient control his bony articulations and struggle against the danger of progressing deformities. The additional mechanical aid and relaxing effect of constant heat given the patient by under water therapy is of tremendous value both in local and general physical improvement, and increases the patient's optimism.

While Dr. Smith says that each case must be treated individually he does not to my mind sufficiently emphasize the fact that damage can be done by the use of massage and active motion in even moderately acute arthritics, and that fatigue is to be avoided. His warning that much of the good work done by the experienced physician can be ruined when the patient returns to the care of one less experienced, should be carried one step farther and emphasis placed on the possible harm resulting from indiscreet use of physical therapy by a great many physicians who do not have the advantage of Dr. Smith's experience.

Dr. Lloyd T. Brown (Boston): Dr. Hartung said that faulty posture could not cause arthritis and the correction of faulty posture would not cure arthritis. On this we are agreed. But, he also went on to say a very important thing that arthritis is a constitutional disease and therefore a disease of every system of the body. If this is so, any form of treatment we are going to institute should include every system of the body. Since experience has shown that some patients recover after the administration of vaccines, colonic irrigation or attention to food allergy this must mean that is isn't any one remedy that is all inclusive.

We have reached one very definite conclusion. There is one definite and common symptom, common finding in all of those, and that is what Dr. Hartung has called faulty posture and which we have called faulty body mechanics. We feel that faulty body mechanics include not only the spine but all the other systems. Dr. Hartung said that the hypertrophic form of arthritis occurs usually in the so-called stocky type of individual. We also agree with him that the atrophic form is encountered in the slender type of individual. There is a great physiologic difference in those two types. The difference is in the bony structure, in the musculature, in the nervous and in the endocrine mechanism. The lumbar spine, for example, in the slender type is similar to the square dorsal vertebrae. In the heavy type the vertebrae are broad and flat. The slender type shows anatomically a much greater curve and much greater mobility of the spine than is seen in the heavy types. In other words, we may get a slender type of individual with reasonably bad spinal curves and a heavy type of individual with curves not nearly as bad. Thus the heavy individual will be in a much more dangerous position from the point of view of trauma than the slender one. It is not the degree of curve in one person's spine as compared to that in another person's spine that is important. The curve of the spine occurs in different places. In the slender type it is much lower than in the heavy. That is due to the shape of bones. Both of those spines are perfectly normal. They are peculiar to these persons. Each has its own type of motion and its different troubles. If the person uses his chest with the body in a forward position, the diaphragm arches upward and forward, so that at the lower end of the diaphragm and the epigastrium there is the greatest amount of room. If that person slumps the body the diaphragm is sloped down and the amount of room in the epigastrium is very small. There is the visceroptosis Dr. Hartung spoke about. If we look straight through from the front to the back, we will find a heart that is relatively well shaped, a diaphragm that is up between the eighth and ninth rib. The chest cavity, the lung cavity from the top down is relatively short. With a body in extreme faulty mechanism, with a chest going down, the diaphragm is low. It cannot stay up. The heart is necessarily also pulled down. The length of the chest cavity is great, which means that the lungs themselves are pulled out of their extreme elasticity. That is something that is not sufficiently taken account of in the treatment of tuberculosis. With the diaphragm and the heart down, there must be some sort of pressure and lessened efficiency in the region of the pancreas and the great organs of the upper abdomen, with resulting lessened resistance. If we allow our children to go around with their bodies out of shape largely because of lack of education, we certainly are missing one important factor which we can easily correct. It doesn't take much training to teach the children how to put their bodies into a position of a good body mechanism. When

one's body is in good body mechanics the internal organs can work properly.

We do not cure arthritis. We make it possible for nature to cure arthritis. Nature in a body working in good condition can certainly do more toward the cure of arthritis than in a body that has a faulty mechanism, which Dr. Hartung has so well brought out today.

Dr. Josephine L. Rathbone (New York): There was just one question that I would like to ask Dr. Hartung and Dr. Smith. I wondered whether or not they had evaluated the effects of exercise per se in contrast to the effects of changes in postural or static alignment?

Dr. G. C. Ames (New York): In a symposium of this kind one should not forget the importance of the tonic value of ultraviolet and vitamin D. The bones of the human system require their daily amount of calcium. The calcium must be had from the products of irradiation. A sense of well-being can be obtained by getting the body irradiated under ultraviolet light.

Dr. Edward F. Hartung (closing): In answer to Dr. Rathbone, exercise per se, in my estimation, is not as important as the postural alignment. This depends more on a neuro-muscular mechanism than on muscular strength. It is well known that athletes have good muscles, but very often poor posture. The oarsmen on the college crew invariably have scoliosis. The emphasis, therefore, is on postural mechanics and not at all on exercise and muscular strength. The difference between what Dr. Smith said and this is that Dr. Smith was interested in deformities due to arthritis; for example, flexion deformities, which is not within the province of our particular postural problems. I mean that postural correction is only of value in very early cases of arthritis. Postural correction is impossible with the advanced arthritic. The under-water exercise involves flexion deformities which is not beyond the province of my presentation.

Dr. Euclid M. Smith (closing): I merely want to reëmphasize one of the things that Dr. Ralph and Dr. Gratz brought out in their discussions of these papers, and that is the organization and reorganization of what to do, what to tell the patient. It is, after all, a question of education.

In regard to Dr. Rathbone's question regarding the exercises, as Dr. Hartung said, they are for correction of deformities that already exist. The question of posture and faulty mechanics is not altogether of great importance.

Dr. Maurice F. Lautman (closing): I am sorry that my paper was so indefinite on some viewpoints, and I am glad Dr. Stump brought them out without making it a controversial matter. I do not believe that I stated that it was my concept that exostoses caused pain. If I gave that impression, I did not mean it. I believe that the exostoses have very little to do with causing pain, that the pain results more from a radiculosis and an involvement of the nerve roots and trunks, so that the pain is referred to as the result of the involvement of the nerve roots rather than from the exostoses.

The other point that he brought out was also something that I do not believe I stated. At any rate, it is my concept that the Strümpell-Marie spondylitis is a variety of the atrophic type, as Dawson has pointed out. I simply did not discuss that form of spondylitis because it was not within the scope of the paper. I particularly wanted to emphasize those mild cases which are frequently overlooked and which are associated with rheumatoid disorders.

PROCEEDINGS OF THE FIRST INTERNATIONAL CONGRESS OF SHORT WAVE THERAPY IN VIENNA *

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NEW YORK

The two issues which practically dominated the First International Congress of Short Wave Therapy which convened this summer in Vienna, dealt with (a) any specific electric effects of short wave diathermy, and (b) the most effective dosage in the treatment of acute and subacute local infections.

There were also a number of papers on biological problems, which I first summarize herewith.

The overwhelming opinion was that short wave diathermy in therapeutic doses has no bactericidal effects. Among others, Hasche, Leuning, Loch, Schweinburg and Reute were very emphatic on this score and were not challenged.

Raab showed that short wave diathermy had no deleterious effect on fertilized chicken eggs. They were hatched in exactly the same time when kept under a temperature of 38-39 degrees C., irrespective whether this was obtained by short waves or the incubator. No changes were observed in the histology and function of testicles of rabbits that were subjected to short wave diathermy. His results were identical with those of Pickham.

Weiss reported his experiments on the circulation in the tongue of the frog under the influence of short wave diathermy, concluding that the findings of Pflomm, who experimented on the frog web, were due solely to the thermal factor.

Malov presented additional experiments on the fruit fly confirming that the death of the fly was satisfactorily explained by pure heat action.

Another interesting biologic fact was brought out by Rajewski. He contended that we must look upon living tissue as a conglomeration of condensers, the living cells and their membranes representing the dielectric. He measured the electric constant of living tissue (liver, blood) immediately after the death of the animal and continued observations until decomposition of the cells (subsided glycolysis or hemolysis) set in. The figures obtained showed that the dielectric constant changed with the progressing destruction of the living cells, finally approaching the conditions of a homogeneous electrolyte. Rajewski suggested the possibility of using these changes for diagnostic purposes.

Ornstein also came to the conclusion that we should regard living tissue as a set of condensers. He believes that the different action of low and high energies may be explained by the assumption that high energies break through the thin cell membranes (dielectric) and cause a short circuit.

So far as specific effects of high frequency currents are concerned, some have been demonstrated only under special conditions, and it is therefore an open question whether these effects have any relation to the therapeutic use of short waves.

Jellinek for instance, demonstrated microscopic changes in the tissue of persons struck by lightning. He showed corkscrew formations which are obviously specific effects of electricity, inasmuch as they never have been observed under any other condition. However these observations do not constitute any evidence of a specific action of short waves in therapeutic doses.

* Read at the Sixteenth Annual Session of the American Congress of Physical Therapy, Cincinnati, Ohio, September 20, 1937.

Krasny-Ergen showed moving pictures of milk and blood flowing through a field of high frequency currents. It could be seen that the fat drops and the blood corpuscles formed pearl chains in the field. As these formations were dependent on the direction of the field they must be due to a specific electric effect, since purely thermal effects are independent of the direction of the field. These chain-like formations were observed regardless of the wavelength employed.

Weissenberg and Dalton showed results of experiments on animals and humans under the influence of very small dosage (less than 5 watt). Dalton used nerve-muscle preparations of the summer frog and found that the latent period increased, and that the amplitude and duration of the contraction decreased under the influence of low intensity treatments (1 to 2 watt). Heat effects are obviously unlikely. He could not observe the same findings in winter frogs. As Weissenberg's experiments will be published in the ARCHIVES, I refrain from further referring to his work.

The topic of especial interest was a report by Liebesny on short wave therapy in nearly athermic dosage. Liebesny takes a stand against those workers who in the belief that the thermal factor is the deciding one use high energies in the treatment of local infectious processes. He pointed out the undesirable effects of high temperatures, and by contrast presented two patients, one with an old tuberculous infection of the hand, the other of the sacrum and bladder who were completely cured by his method.

Out of 14 discussers only 3 took a negative attitude. It is emphasized that Liebesny speaks only of a nearly athermic treatment, so that the question of the existence or non-existence of a specific electrical effect of short wave diathermy has no bearing on the problem. Besides the two views of specificity or non-specificity do not contradict one another. The galvanic current to illustrate also has two actions, a heat effect and an ionizing one.

This attitude of the congress in respect to this low heating value cannot be stressed enough in view of the trend to judge the value of an apparatus by the intensity of the heat it can produce.

Experiments which your reporter conducted and presented to the congress, seem, in his opinion, to indicate that the difference in the action of low and high energies lies in anatomic factors. The thin-walled capillaries are dilated by weak energies and the circulation in the edematous inflammatory tissues is improved by increased drainage, while high energies dilate the arteries, increase the inflow and impair the circulation.

Up to now when we wanted to determine and compare the amount of energy actually at work in a patient, we had to depend only on the statement of his sensations. This has stimulated efforts to establish methods of measuring the dosage. Klauss, Mittelmann and others have constructed various measuring devices which have been found fairly reliable. The basis of their working, however, is highly technical and I do not consider myself capable of satisfactorily explaining them.

Reviewing some of the clinical suggestions, a number of authors stressed the efficacy of short wave diathermy in local tubercular affections. In addition to Liebesny, Gutsch and Krausz reported favorable results in tubercular affections of the eye.

American physicians will be particularly interested in many reports confirming the remarkable effect of short wave diathermy in the treatment of lung abscesses. I may mention only Grynbaum, Dieker, Hrabovsky, who among others warned against the use of intense dosages.

A similar consensus of opinion was expressed by the gynecologists. Wintz, however, differs with Raab, inasmuch as he finds short waves valuable in the acute cases, while Raab does not. The difference lies most

likely in the difficulty of correct dosage and technic, which was stressed by many. It appears strange that the European physicians do not accentuate the difference between gonorrheal and non-gonorrheal conditions. It cannot be denied that short wave diathermy may relieve the inflammatory process regardless of the etiologic factor, but no bactericidal action can be expected of the low energies used. We in America consider hyperpyrexia as the treatment of choice, because we can reach the lethal point for the gonococcus without hurting human tissues and thus produce a true bactericidal effect. From our point of view the European physicians do not appear to attack the gonococcus.

In general the speakers concurred that inflammatory processes are the main field for short wave diathermy, particularly adnexitis and parametritis. Wintz advises against short wave diathermy in tubercular affections of the female genital organs, but his unfavorable experiences may probably be attributed to faulty dosage. As far as menstrual disorders are concerned according to Nicotra only functional disturbances respond. Raab claims that treatments through the hypophysis seem to be of more value than applications to the ovaries.

All speakers discussed the difficulty of correct technic in treating gynecologic conditions. Korb, assistant to Wintz, describes a method of placing the electrodes in which the patient pulls up her legs and one electrode is placed under the sacrum, the other under the thighs. A special table was constructed for this purpose.

Meyer, of Paris, and Siegen, of Kudowa, reported on the treatment of angina pectoris. Meyer specifies that he obtained the best results in cases of effort angina and poor results in those patients who had severe attacks of off and on with free intervals. Thus he had the same experience that we have had when using long wave diathermy. Blood pressure should be taken during the treatment. If it rises, the dose is to be reduced or the treatment discontinued. Siegen is more optimistic. He claims, on the basis of electrocardiographic control, that he cured 43 and saw improvement in 54 per cent. Both authors employ medium dosage. Siegen states that the intensity of the treatment must be regulated according to the reaction of the patient.

In cases of bronchial asthma Meyer reports very good results in children but mediocre ones in adults. In the discussion exception was taken by Schliephake, who stressed the allergic nature of asthma and doubts whether it can be influenced by any local treatment. The individual attack may yield but we have other medicinal ways to accomplish this more easily and more quickly.

Interesting points were brought out in the field of otology from the clinic of Neumann. His assistants, Meller, Lowy and Fuchs, reported the great value of short wave diathermy in cases in which a radical operation for otitis media had been performed. No results however were obtained without resorting first to a radical operation.

Gutsch, Hausmann, Rieger, Rabinowitch and Krausz spoke on the use of short wave diathermy in ophthalmology. With slight variations they agreed on the excellent results obtained and that inflammation of the lacrimal ducts responded as could be expected. Spectacular was the report of Gutsch of a case of orbital abscess which had forced the eye out of its socket. The day after a treatment of 10 minutes duration the eye returned to its normal position and was freely movable. A similar favorable result was seen in abscess of the vitreous. Gutsch saw no results from the treatment in diseases of the cornea and sclera, in diseases of the lens and in glaucoma, opticus atrophy and detachment of the retina. Temperature measurements revealed an increase to 41 degrees C. and marked dilatation of the vessels

of the retina were observed. This must help in the resolution of infiltrations, exudates, blood extravasations, retrobulbar neuritis, and the like. Noteworthy were the results in two cases of tubercular affections of the eye The one showed a large vesicular exudate, the other tubercular nodules. Both were cured with complete restoration of vision. A similar case of tubercular nodules was reported by Krausz.

With minor differences similar results were obtained by others. Rieger, Gautsch saw no results in the treatment of spontaneous chronic iridocyclitis, while Krausz had cures to report. To avoid an influence on the hypophysis, Rabinowitsch, of Liebesny's clinic, uses an apparatus giving 3 meter waves with a maximum output of 60 watt She places one electrode 3-4 cm. before the eye and the other 10 cm. behind the occiput.

About the treatment of vascular disorders I gained the impression that our European colleagues do not analyze these conditions sufficiently. Liebesny mentions the use of arteriography and its prognostic value. However, they do not stress the difference between dry and wet gangrene, they do not seem to have our appreciation of thermoregulated heaters, pressure and suction. At any rate they are inclined to use one method only: short waves in all cases. A selection of the method most suited to the individual case is not made, as far as I can judge.

The question of short wave against long wave diathermy was not touched upon. Schliephake, however, in his latest article states that in chronic conditions both have equal value. Obviously we are coming closer together. Kowarschik mentioned to me in a personal conversation that he still believes in conventional diathermy which will keep its place just as other heat producing modalities, such as infra red rays.

I have omitted a report of the papers on the physics of short waves. Most of them were highly technical and had no apparent connection with medical problems. I only want to mention that the use of 3 meter waves was suggested because fatty tissue is more equally heated by shorter waves (Paetzold). If, however, we consider that the rule seems now to be established to use low energies only, these suggestions retain only a theoretical value. No definite stand was taken regarding an optimum wavelength.

Reviewing the congress as a whole it must be said that it was remarkably successful. No fantastic claims were advanced and the differences of opinion were probably due to different interpretations, different technic and probably in the variations of clinical pictures as they are known to occur in various countries.

The variety of languages used (four) was an obstacle for many, particularly as no effort was made to translate the various papers.

For us physicians from the United States it was somewhat unexpected to find medical problems and radio technic combined. Most of the papers on the physics of short waves had no bearing whatsoever on medical practice. On the other hand some of the papers, for instance on dosimetry read in the section on physics should have been presented in the medical section.

667 Madison Ave.

ALTERNATE SUCTION AND PRESSURE THERAPY IN PERIPHERAL OBLITERATIVE VASCULAR DISEASES *

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NEW ORLEANS

The treatment of obliterative vascular diseases of the extremities by alternate suction and pressure is more than a century and a quarter old. Allen and Brown[1] point out that it had fallen completely into disuse until its revival some three years ago by Landis and Gibbon,[2] and Herrmann and Reid.[3] Since then it has been used extensively in certain clinics and casually in others, hence the conflicting reports as to its value. Favorable results have been reported by Herrmann and Reid,[4] Landis and Gibbon,[5] Landis and Hitzrot,[6] and J. Herbert Conway.[7] Less impressed are Wilson and Roome,[8] and Allen and Brown;[1] indeed, they seriously question whether the amelioration achieved by this method could not equally well have been attained with other and perhaps simpler measures.

Even with extensive employment of the procedure it has been used too short a time to justify an opinion about the permanency of the results. It has not been sufficiently stressed that obliterative vascular disease is a slow degenerative process extending over many years, and that the process of repair is always equally slow. Sufficient time, however, has elapsed to form some opinion of its merits, a consideration which is extremely important to the subjects of these diseases and for that reason should not be lightly dismissed.

We have employed this method only six months, far too short a time to permit us to speak with any authority. We have used it in only 35 cases, long enough to enable us to judge of its worth in the amelioration of symptoms. We have, however, studied these cases from certain points of view which apparently have not been considered by other workers. An additional justification lies in the fact that no other auxiliary treatment has been employed; so that results have been achieved solely by this method, plus, of course, such elementary precautions as are outlined by Reid and Herrmann.[9]

In the beginning we selected our cases on the basis of a clear cut clinical history in which the vascular factor was uppermost, and a thorough general and local examination. We eliminated cases with active infection of any marked degree, as well as those associated with large sloughs, massive gangrene and bone necrosis. Clearly, when the disease has progressed to such a point, it is folly to consider any but radical methods of treatment.

In 30 cases the basic pathologic process was arteriosclerosis, in 4, vasospasm, and in 1, (a white male, 41 years of age), traumatic occlusion of 18 months duration of the upper right brachial artery. In 12 of the arteriosclerotic cases diabetes was present, but since it has been clearly established that the pathologic background is essentially the same in simple arteriosclerosis as in diabetes, we made no distinction between them except to control the metabolic condition before treatment was begun. Three of the patients in the vasospastic group exhibited Raynaud's syndrome with pain, cyanosis

* From the Departments of Surgery of the Louisiana State University School of Medicine, and the Charity Hospital in New Orleans.

* Read at the Fifteenth Annual Session of the American Congress of Physical Therapy, New York City, September 8, 1936.

and trophic changes in the fingers and hands; in the other patient the feet and lower legs were affected.

The predominant symptoms for the relief of which this treatment is primarily directed, and the underlying pathologic process are set forth in the following table:

Gangrene (arteriosclerotic and diabetic)	10 cases
Intermittent claudication (arteriosclerotic)	9 cases
Night and rest pain (arteriosclerotic)	7 cases
Exercise and rest pain (arteriosclerotic)	4 cases
Pain and cyanosis (Raynaud's syndrome)	4 cases
Digital pain, arm and hand weakness (traumatic brachial occlusion)	1 case

Very early we became impressed with the variability of our results. Some patients improved immediately, others did not improve at all, still others grew worse. It seemed clear that the fundamental trouble lay in the selection of cases in spite of the care used, so that purely clinical methods did not seem satisfactory.

Arteriography

In this dilemma we turned first to arteriography. This method we have employed with complete satisfaction for the past four years in the study of all types of peripheral vascular diseases. The agent used was thorotrast Heyden (stabilized thorium dioxide) which was found effective and safe in the minimum doses needed, and in no instance have we observed deleterious effects, such as thrombosis, embolism or spasm of the vessels.

By this method we demonstrated that a wide variety of vascular patterns accompanies obliterative peripheral vascular diseases, particularly arteriosclerosis. In some cases the larger trunks are chiefly affected by the obliterative process, while the formation of collateral vessels represents a compensatory process which at least keeps abreast of the vascular degeneration. We have noted in other cases localized areas in which there is narrowing of the large trunks and almost complete obliteration of the smaller branches. In still other cases it was seen that the most marked obliteration occurs in the small branches, the arterioles and capillaries. Finally, we have observed a group with generalized obliteration of both large and small vessels in which the destructive has far exceeded the reparatory process.

Observation of the patients under treatment by means of arteriography revealed a definite correlation between the basic pathologic process and the results of treatment. When the vascular tree was damaged but still permitted a considerable volume of blood to enter the limb (fig. 1), improvement was always noted. When the obliterative process was well marked, especially with diminution in the volume of blood flow below the cuff (fig. 2), the improvement was slight. When the femoral artery was obliterated above the cuff, with extensive destruction of the vascular bed, (fig. 3), improvement was never noted. As a result of these studies, we are now able to select our cases with a considerable degree of confidence, and to prognosticate with a high degree of accuracy when the treatment is likely to be effective or a waste of time.

We further concluded from these studies and from the follow-up arteriographic observations, that the action of alternate suction and pressure on the blood vessels of the extremities is more than a simple passive lowering of the peripheral resistance. Invariably when there was a large volume of blood below the cuff, whether it was in the collaterals or in the regular vessels, there seemed to be a rapid distention of the existing vessels and a development of new collaterals, which was always more notable in the very small vessels.

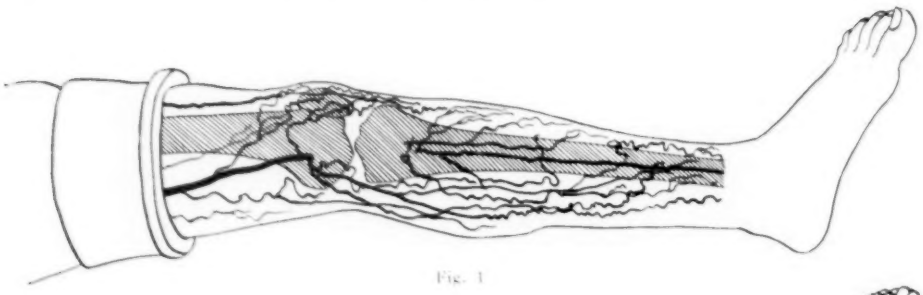


Fig. 1

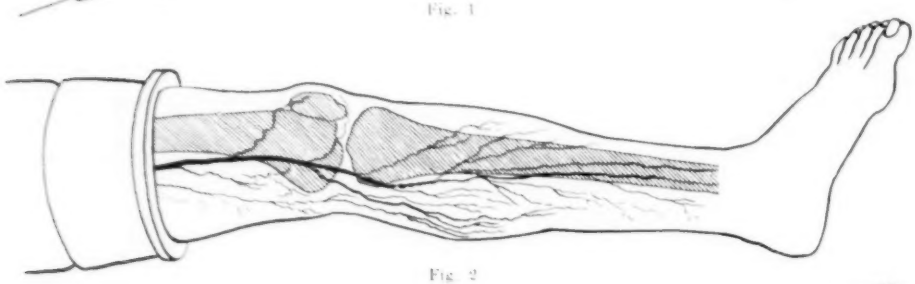


Fig. 2

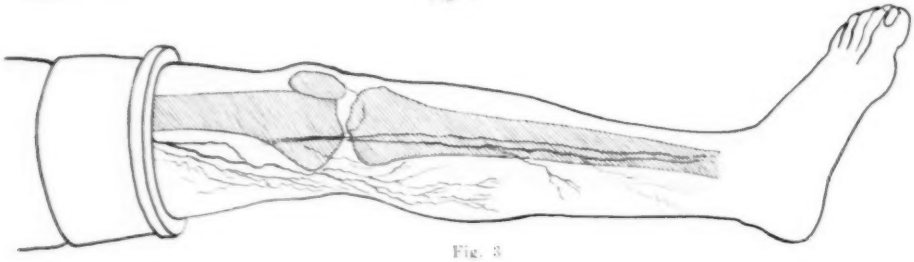


Fig. 3

Fig. 1.—Schematic drawing from arteriograph taken at rest period; arteriosclerosis; obliteration of popliteal artery; extensive collateral development; intermittent claudication.

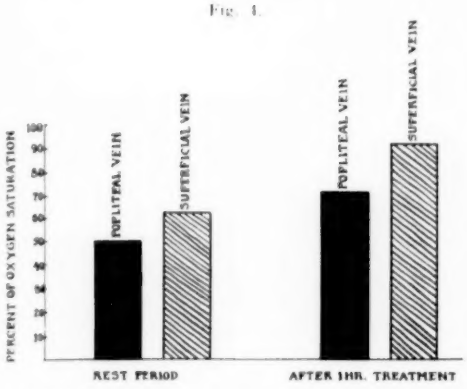
Fig. 2.—Schematic drawing from arteriograph taken at rest period; arteriosclerosis; marked diminution of vascular bed; intermittent claudication; rest pain; cyanosis of toes.

Fig. 3.—Schematic drawing from arteriograph taken at rest period; arteriosclerosis; high obliteration of femoral artery; extensive destruction of vascular bed; intermittent claudication; rest pain; cyanosis of toes.

Chemical Changes in the Blood

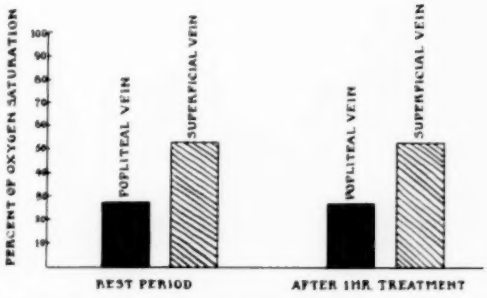
To prove our conclusion that the action of this method is more than a passive lowering of peripheral resistance, we began a series of studies on the chemical changes in the deep and superficial venous blood before and after treatment. Our thanks are due Dr. William M. McCord, of the Department of Biochemistry, for the assistance in this part of the work. With the patient at rest samples of blood were drawn from the popliteal vein and from the superficial veins of the dorsum of the foot or of the lower part of the leg just before treatment and after an hour's treatment. When the vascular bed was extensive, there was invariably an increase of the oxygen content of the blood of the second (post-treatment) specimen (fig. 4). When the arterial system was extensively damaged and the blood volume markedly diminished, there was no change in the oxygen content (fig. 5). Furthermore, as treatment was continued, we found that the oxygen content remained at its original high level, or increased, sometimes very considerably, in all the cases in which any increase at all had been noted, while there was never an improvement in the cases in which the first pre- and post-treatment readings had been the same. From these studies, which will be published in detail at a later date, it seems reasonable to assume that this method of therapy not only lowers peripheral resistance in the arterial system but actually distends the smaller vessels and draws blood through them.

Fig. 4.



Graph showing increase in oxygen saturation of deep and superficial venous blood of extremity after 1 hour of alternating suction and pressure treatment.

Fig. 5.



Graph showing no change in oxygen saturation after treatment in patient presenting obliteration of lower femoral artery with poor collaterals

The increased blood flow and the opening up of non-functioning capillaries naturally improves the nutrition of the affected parts.

From the standpoint of results, we would reiterate that this method does not cure obliterative vascular diseases. There is no doubt, however, that in properly selected cases it ameliorates symptoms by increasing the blood flow and promoting the development of the collateral circulation, both of which improve the nutrition of the extremities. It is quite possible, too, though no direct proof as yet exists, that by this method of treatment the degenerative process may be arrested, if not cured, and it seems reasonable to assume that by it some disasters, at least, may be averted. Many of Herrmann and Reid's reported results lend support to this theory. How permanent the improvement will be is another matter, but even temporary results seem better than immediate radical surgery.

Clinical Grouping

We have divided our cases into three groups. In the first or markedly improved group are the patients whose gangrenous areas healed, those who obtained relief from night or rest pain, and those with intermittent claudication who have been so much benefited that they have been able to resume their usual occupations.

Group 1

Gangrene of a single toe (diabetic)	3 cases
Gangrene of a single toe (arteriosclerotic)	3 cases
Severe rest pain (diabetic)	1 case
Intermittent claudication (diabetic)	1 case
Traumatic brachial occlusion	1 case

The case of traumatic occlusion of the brachial artery deserves special mention. Eighteen months prior to admission to our clinic the patient was struck over the right brachial artery with a sharp piece of wood. There was immediate swelling of the forearm and hand, the radial pulse was absent, and the hand was cold and cyanotic. Under heat the swelling and cyanosis gradually disappeared, and the radial pulse became perceptible, though quite feeble. The arm and hand remained weak and easily fatigued. The fingers would blanche at times, and were painful. On admission we made an arteriograph which showed the occlusion of the brachial artery at about its middle portion. Collateral vessels were forming and the ulnar and radial arteries seemed to be smaller than normal. We began alternate

suction and pressure treatment. After 20 hours (1 hour daily) the patient stated that the pain in his fingers had disappeared. After 35 hours he stated that the weakness no longer interfered with his work. A check-up arteriograph was made and revealed that abundant collaterals had developed. The radial and ulnar arteries were increased in size. The point of occlusion, however, was still apparent.

In the second group are those patients whose progress has been satisfactory, but whose improvement has been less marked. It includes patients with rest or night pain who are now able to sleep without medication, and patients with intermittent claudication or exercise pain who are able to walk farther than they did and suffer less severe pain than they had before treatment was begun. It is quite probable that with additional treatment it will be possible to shift many of these patients to group 1.

Group 2

Severe rest pain (arteriosclerotic and diabetic)	4 cases
Intermittent claudication (arteriosclerotic and diabetic)	8 cases
Intermittent claudication with rest pain (arteriosclerotic)	2 cases

In the third group are the failures, the patients who showed no relief of symptoms and those whose condition has grown worse under treatment.

Group 3

Raynaud's disease	4 cases
Gangrene of toes and foot	4 cases
Rest and exercise pain and cyanosis (arteriosclerotic and diabetic)	4 cases

In slightly more than a third of the whole group the results were entirely unsatisfactory, and in exactly a third of the failures Raynaud's disease was the underlying cause. In all four cases the symptoms were aggravated by the treatment, and our experience, combined with that of other observers, leads us to say that this form of therapy is entirely useless in purely vasospastic diseases. Whenever the gangrenous process extended beyond the web of the toes, or whenever active infection of any degree was present, again the process was aggravated and the patient's discomfort was increased. Extensive gangrenous processes and infection of any degree accordingly must be added to the list of contraindications.

In the remaining four cases of arteriosclerotic disease exercise and rest pain and marked dependent cyanosis were the outstanding complaints. In all the feet were cold and no pulsation could be detected in the dorsalis pedis or the posterior tibial arteries. In other words, each of these four cases presented a severe grade of arteriosclerosis. In two patients 65 and 70 years old, there was almost complete obliteration of the femoral artery and arteriographs could not be made; in the others, who were 57 and 59 years old, arteriographs showed extensive arteriosclerosis with obliteration in one case of the lower femoral and in the other, of the popliteal artery, while the collateral circulation was frankly inadequate in both. In no case was there any increase after treatment in the oxygen content of the deep and superficial venous blood. One patient developed cardiac failure soon after treatment was begun so that it had to be discontinued. Treatment was kept up for a longer time in the other cases, but in none was any improvement evident, and in the light of the vasographic and chemical findings it could not be expected that there would be any.

The same technic was used in all patients, that recommended by Herrmann and Reid, which consists of four short cycles to the minute from minus 80 to plus 20 mm. of mercury. One or both extremities were treated as was indicated. The severe types were hospitalized and treated twice daily, an hour at a time, the less severe cases were ambulatory and were treated

once or twice daily for the same length of time. The average hours of treatment varied from 6 to 113. In only three cases, one of gangrene and two of Raynaud's disease, in which there was a prompt aggravation of symptoms, was the treatment less than 12 hours. In the markedly improved group the average hours of treatment was 48.6, in the slowly improving group 41.5, and in the group of unimproved cases it was 27.3 hours.

Recently we have adopted the plan of giving to each patient by mouth 30 minutes before treatment half an ounce of alcohol. The vasodilator properties of this agent are well known, and it seems reasonable to assume that when it is employed, an increased amount of blood will pass through the vessels during treatment. So far we have only subjective results to report from it. Some of the patients state that they actually feel as if more blood was coursing through their limbs during treatment, others report a sense of increased warmth in the treated extremity, and still others have described a sensation of ants crawling through their toes which was not present when alcohol was not used.

Our plan of treatment for the future will be to select our cases, as formerly, on the basis of the clinical history and general and local examination, but we shall eliminate all cases in which infection is present or in which gangrene involves more than small or superficial areas. We shall not treat cases of vasospastic disease. Any patients in this carefully selected group who do not show prompt improvement of their symptoms will be studied by vasography and the oxygen saturation test, and we shall discontinue the treatment when the basic process is the kind in which results cannot be expected and those in whom the oxygen saturation content of the venous blood does not rise after treatment. This much our limited experience has already taught us.

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TRANSCEREBRO - SPINAL CALCIUM IONTOPHORESIS IN BRONCHIAL ASTHMA

Preliminary Note

AVROM BARNETT, M.D.

BROOKLYN

The use of transcerebral iontophoresis has been singularly neglected in this country. It was first employed in the French army during the World War by Bourguignon[1] who was seeking a method for reducing the extreme spasticity in hemiplegia following brain trauma due to penetrating wounds or fractures of the skull. His technic consisted in applying a small tin electrode covered with absorbent cotton and soaked in 1 per cent calcium chloride over the trepan opening in the skull and a similar large negative (tin) electrode soaked in tap water to the back of the neck and passing 3-10 milliamperes for 30 minutes. He chose to use calcium ions because of their well-known property of reducing the irritability of nerve tissue, the spastic hemiplegia being considered as an irritative lesion following the brain insult. The marked improvement observed in a great many cases led Bourguignon to attempt treatment of medical hemiplegias in the same way, the positive electrode being applied to the shaven skull over the motor area contralateral to the affected side. However, in view of the consistently negative results obtained, this procedure had to be abandoned. The investigator believed that, in these cases, the intact skull prevented the passage of current into the subjacent brain substance and that unless a free path were made or found no effect could be obtained. He was led thus to attempt to use the eye as a portal of entry for reaching the cerebral hemispheres, the opening at the back of the orbit serving as the pathway for passage of the current. The soundness of this choice was soon reflected in the improved clinical results obtained and by a series of confirmatory experimental studies.[2-10] The fact that the current traverses the brain was domonstrated by actual measurements of the chronaxia of upper neurons.[2] With the stimulating electrode applied to one eyelid, twitches could be elicited in the muscles of the hand or leg on the contralateral side. The current was therefore assumed to flow as shown in figure 1, from the eye through the brain to the pyramidal tract on the same side, where excitation took place, the crossed response resulting from decussation of the pyramids. Later, in collaboration with Elipoulos[3, 4, 5, 6, 7] he was able to show that when calcium ion is introduced iontophoretically into the brain through one eye, the oscillometric index taken on the arm on the opposite side increases markedly. The effect could not be produced (1) by passage of current alone, (2) by injection or (3) by ingestion of calcium salts without use of a current[6, 7] and indicated that the combination of current and calcium ion is capable in some way of modifying the cerebral vasomotor or sympathetic centers to produce the effect observed.* It is this experimental observation which served as a point of departure for the present communication.

Since the time that it was first shown that injections of adrenalin solution were capable of arresting attacks of bronchial asthma, it has been generally recognized that the sympathetic nervous system plays an important role

* This effect becomes markedly asymmetrical in hemiplegies[8, 9] and is sufficiently consistent to have permitted discovery of a case of non-decussation of the pyramidal tracts from atypical oscillometric findings during transcerebral iontophoresis.[10]

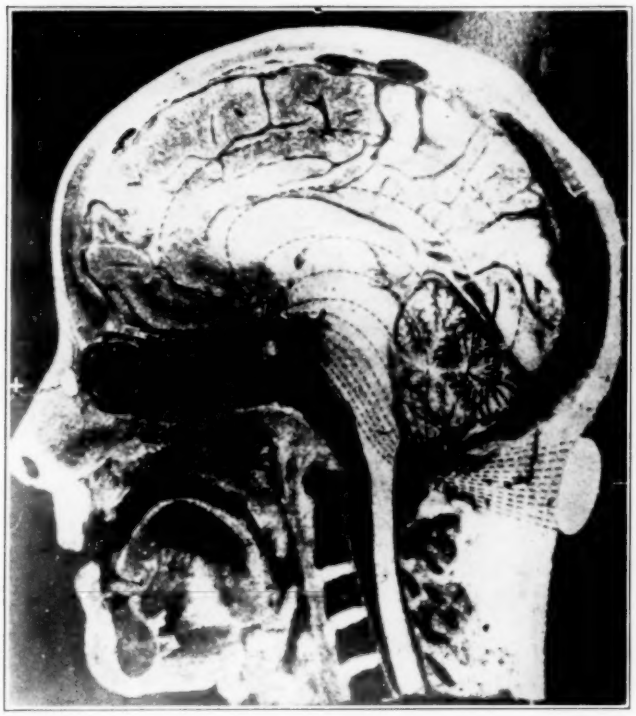

Fig. 1. — Diagrammatic representation of the current path through the brain in transcerebral iontophoresis (Bourguignon).

in disturbances of this kind. If one could be certain that, by utilizing the technic of Bourguignon, sympathetic function could be modified, this treatment would constitute a logical therapeutic attack in a field where failures have been all too frequent. Although the work of Bourguignon and Eliopoulos referred to above on the crossed vasomotor effect appeared to indicate that cerebral sympathetic function might be modified, there was no assurance that the effects would be lasting. Moreover, the disturbances observed in bronchial asthma may be referred, more reasonably, to the thoracic rather than to the cerebral portions of the sympathetic system and no evidence was at hand to show that any effects whatever could be produced along the spinal sections of the sympathetic chain. For these reasons and because of the discouraging results generally obtained by other methods in the permanent relief of asthmatic conditions, attempts at treatment by iontophoresis were postponed by the writer for a number of years until the occurrence of a case of bronchial asthma as part of an unusual sympathetic syndrome in the author's immediate family gave opportunity for the first therapeutic trial.

The patient, a school teacher, aged 37, single, had suffered from typical nocturnal attacks of bronchial asthma which began in January, 1929. The attacks were confined to the fall and winter months, were aggravated by "colds" and could be relieved by adrenalin. She had been seen by several allergists who, after appropriate tests, had tried various desensitizing types of treatment without any resulting benefit to the patient. In September, 1933, following a "cold," the first asthmatic attack of that fall season occurred and was followed by three others in the course of the next two weeks; at the same time the patient observed a marked unilateral exophthalmus which had developed on the left side and complained of frequent

and violent headaches. Physical examination at this time revealed nothing of note except the unilateral exophthalmus and an increase in blood pressure to 176/100 from a level of 140/85 which had been found about six months previously. An ophthalmologic examination by Dr. G. Freiman of the Long Island College Hospital on October 13, 1933, confirmed the existence of the left exophthalmus, but no pathological process could be found in the structures within the orbit to explain its origin. To rule out the possibility of thyrotoxicosis, a basal metabolism was done and gave a value of minus 5 per cent. This was checked by phase angle measurements[11] (Brazier technic), which also fell within the normal range (0.112). X-ray plates were made of the sinuses and the chest but the findings were essentially negative.

The clinical picture — unilateral exophthalmus, bronchial asthma and hypertension — was not such as to fit readily into any convenient nosological category and suggested possible unilateral sympathetic irritation of unknown origin and locus giving rise to the triad of symptoms observed. In the absence of any promising therapeutic attack on such an unusual condition, it was thought that the transcerebral iontophoretic method of Bourguignon might be given a trial, but in view of the fact that the symptoms had evolved over a period of only two weeks, an expectant policy of treatment was deemed advisable. No medication of any kind was given. The patient was told to rest as much as possible and reassured that the exophthalmus, given time and patience, might right itself. She was seen at two week intervals over a period of three months (November and December, 1933, and January, 1934), without any change being observed in the clinical status. The exophthalmus according to a report made by Dr. Freiman on January 16, 1934, appeared to have become fixed and the asthmatic attacks continued at the rate of one to two a week. At this time, the patient reported that the children in her class had noticed "something funny about my eyes." She refused to be reassured any longer and insisted that "something be done." A series of treatments by the transcerebro-spinal iontophoretic method was therefore instituted following the original directions of Bourguignon. One block tin electrode, 1 square centimeter in area, well covered with absorbent cotton and soaked in 1 per cent calcium chloride was applied to the left eye and held in place by broad rubber bands, while the other, measuring 10 square centimeters and covered with absorbent cotton moistened with tap-water was applied to the spine in the lumbar region. A current of 4-6 milliamperes* was passed for 30 minutes daily during the first week, then every other day for the three weeks following. Improvement in the asthmatic condition became evident after the fourth treatment. Diurnal respiration was less labored and the nocturnal attacks ceased. The exophthalmus appeared to have remained stationary, however, and the hypertension was still at the 170-180 systolic level. At the end of two weeks, a slight improvement in the exophthalmus was noted and the systolic blood pressure had fallen to 160-170. The improvement continued at an accentuated rate during the following two weeks so that, at the end of one month of treatment, the exophthalmus had been reduced by fully one-half, the asthmatic condition appeared to have been completely relieved, and the blood pressure level was down to 155/90. Treatment was discontinued at this time, in accordance with the recommendations of Bourguignon who claims that long continued iontophoresis is of less benefit than monthly alternations of treatment and rest. During the ensuing month of rest, no further asthmatic attacks occurred and the gains noted main-

* The eye electrode is of tin background and electropositive in charge.

tained themselves. A second series of treatments similar to the first was then started and continued over the course of the next following month. The condition of the patient at the end of this time with reference to the three cardinal symptoms under treatment was the following: Bronchial asthma completely relieved, exophthalmus reduced by about 75 per cent, blood pressure 155/90.

The patient's condition has been followed over a period of three years since treatment was discontinued. The bronchial asthma appears to have been completely cured, the exophthalmus has improved spontaneously and though still present, is discrete, while the blood pressure varies in systolic level from 160-170 to 140-150 at different times. The marked improvement in the exophthalmus was checked by examinations made by Dr. Freiman on Feburary 7, 1934, and January 21, 1936.

Clinical Reports

In view of the encouraging results obtained in this first case, treatment of a second was undertaken.

The patient, the mother of an associate, a woman aged 56, otherwise in good health, had suffered from attacks of bronchial asthma over a period of four years. The attacks occurred in the late summer, continued throughout the winter with severe nocturnal episodes varying from one to three a week and were relieved by adrenalin. X-ray plates of the chest showed small disseminated scarred pulmonary areas bilaterally, but neither physical examination nor the condition of the patient suggested the existence of any active pathologic process. Because the patient lived at some distance, arrangements were made for home treatment. A small galvanic set was made up by connecting a 22 volt battery in series with a small 50,000 ohm potentiometer (type used in radio apparatus) and an inexpensive milliammeter, the whole assembly being mounted in a small wooden box. The patient was taught at the first four seances to gradually turn the potentiometer until the milliammeter indicated 2-3 milliamperes, and to control the current thereafter so as not to exceed 5 milliamperes. The eye electrode was applied alternately to the right and left sides on successive days. She was seen thereafter at weekly intervals. Improvement was noted at the end of the first week, but occasional attacks of diminished severity occurred as late as the third week. Because of the pronounced relief obtained, the patient, without announcing her intention, increased the frequency of treatment to as many as two a day and continued, against instructions, at the end of one month period until the sixth week. At this time, the asthmatic condition was completely relieved and has not recurred to date (two years). This case is of interest as showing that no harm and, possibly, benefit may be derived from frequent treatment. The simplicity of the therapeutic procedure is indicated by its successful use in the hands of a patient.

During the past year, three additional cases have been treated by this method. One of these, a female aged 23, presented features similar to those described above except that the attacks which had begun two years previously, were spaced at two weeks intervals and continued with remissions over periods of two to three months. Permanent relief occurred after the first series of treatments, but a second series was given to insure against a possible recurrence. This patient has now been symptom-free for nine months.

Treatment of the other two patients, both males, was undertaken as a final test of the method. These were cases of long standing—8 and 10 years, respectively—and of the type described by Anderson[12] and by Lamson and Butt[13] as being associated with diffuse pulmonary fibrosis. Both "wheezed" audibly during inspiration in ordinary speech, were markedly dyspneic and showed on x-ray examination extensive perihilar and peribronchial involvement suggestive of chronic inflammatory processes.

The first of these patients had made the round of the larger hospitals of New York City and vicinity, and had received various desensitizing types

of treatment without benefit. Iontophoresis was undertaken in August, 1936. During the first week the patient experienced marked relief. Whereas he had been unable to walk fast because of "shortness of breath" and attacks of dyspnea, he now reported that he was able to "run for the bus." The improvement maintained itself throughout the course of the month, at the end of which time treatment was suspended. For a week thereafter, the condition of the patient remained unimpaired, but a gradual return of symptoms was noted during the second week, and by the end of a month his condition reverted to what it had been before treatment. A second course of treatments was, therefore, instituted in the hope that more lasting relief would be obtained, but the results were similar to those noted during and after the first series. This patient has been seen from time to time since and reports that he occasionally uses his galvanic set for relief during periods of acute respiratory discomfort.

The history of the second chronic male patient is practically superposable on the first. The x-ray plates of this patient also showed extensive perihilar involvement. Iontophoresis here again afforded only temporary relief. The definitely unsuccessful end results in both of these cases may possibly be ascribed to irritation due to the presence of the chronic, deeply infiltrated pulmonary lesions shown by x-ray examination.

Comment

While the series of patients reported herein is small, the consistent results obtained in the three cases exhibiting disturbances which may be characterized as purely functional indicates that transcerebro-spinal calcium iontophoresis is worthy of further and more extensive trial and study. At the same time the temporary relief obtained in the two chronic cases showing pulmonary involvement indicates that, in the absence of a more effective therapeutic attack, this method may be found useful in diminishing the severity of symptoms during acute episodes of limited duration. It would appear that, in patients of this latter type, the chronic perihilar inflammatory processes act as a permanent source of irritation and effective therapy should aim at resolution of the inflammatory condition. There is no reason to expect that the iontophoretic method described would have such a resolutive action and, while the intra-trachial lipiodol method would seem to constitute a more logical approach, Anderson[12] reports a similar lack of success in cases showing diffuse fibrotic lesions.

Although the researches of Bourguignon and his pupils indicate that transcerebral calcium iontophoresis may be capable of modifying sympathetic function, the precise mechanism and locus of action of the current and of the calcium ions introduced thereby remain to be elucidated.

To the average clinician, the use of a technic involving passage of a current through the eye and the brain appears bold and not without risk. The fact that methods of this kind have been in routine use in hundreds of neurologic cases in the electrotherapeutic service of Bourguignon at the Hospice la Salpetriere in Paris, over a period of years may prove reassuring.* In the writer's experience, no burns or other damage occurred in any of the cases reported here. After about five minutes, patients feel little or nothing as a rule and sometimes complain that the current is not flowing although the milliammeter indication may be as high as six milliamperes.

The method described herein for the treatment of bronchial asthma is being studied with reference to its possible extension to other allergic conditions involving the respiratory tract.

*G. Guillain, Professor of Clinical Neurology at the University of Paris has recently reported[14] the use of the transcerebro-spinal technic (iodide ion) in the treatment of the Guillain-Barré syndrome.

Summary and Conclusions

In five cases of bronchial asthma treated by transcerebro-spinal calcium iontophoresis, permanent relief was obtained in three cases exhibiting a functional type of disturbance and temporary relief in two cases showing chronic peribilar lesions.

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AWARDS OF MERIT BY THE AMERICAN CONGRESS OF PHYSICAL THERAPY FOR THE YEAR 1937

In accordance with the custom of the Congress to bestow honor upon scientists whose contributions to physical medicine and allied sciences have been outstanding, the Board of Governors after careful consideration have conferred the Gold Key of Merit to the following two distinguished physicians whose citations read:

Doctor Kurt Huldschinsky formerly of Germany, citizen of the world. Humanitarian physician, distinguished phototherapist whose studies in the prevention and cure of rickets through the activation of certain substances inherent in the skin by means of ultraviolet irradiation have proved of immense value to humanity.

Doctor Louis Edouard Lapicque, distinguished son of France, noted physician and electrotherapist, inventor of an electrical current named for him and of great diagnostic merit, eminent contributor to the literature with the term of chronaxie.

AWARDS TO SCIENTIFIC EXHIBITORS

The Jury of Awards for Scientific Exhibits presented through its Chairman, Dr. Madge C. L. McGuinness the following awards: Gold Medal to Dr. *Louis G. Herrmann*, of Cincinnati; Silver Medal to Dr. *R. Plato Schwartz* and his associates of the Gait Laboratory, Rochester University School of Medicine and Dentistry, Rochester, New York; Bronze Medal to Dr. *Robert M. Stecher* and Dr. *Benjamin Wolpaw*, of Cleveland. Certificate of Honorable Mention to Dr. *George Lyford*, of Cincinnati; Dr. *Henry H. Kessler*, Newark, New Jersey; American Physiotherapy Association and Visiting Nurse Association of Chicago. Certificate of Special Honorable Mention to Dr. *A. J. Nedzel*, of Chicago, and Dr. *Irwin G. Spiesman* and Dr. *Lloyd Arnold* of Chicago.

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EDITORIALS

THE DOSAGE MEASUREMENT IN SHORT WAVE DIATHERMY

Need of a quantitative method to measure the amount of energy introduced into living tissues for therapeutic purposes by short waves has long been recognized by technical and clinical investigators. By both it is fully appreciated that in the absence of dosimeteric control, short wave diathermy is destined to descend to the level of trial and error practice and to become subject to the vicissitudes of individual opinion. To be firmly established as a scientific and lasting procedure the factor of dosage must be taken out of the realm of theoretic variables and transformed into technical immutables associated with short wave radiation in medicine. If heat is the physiologic vis-a-tergo, it is as important to know the measured amount required in physical units, as it is to realize that continued dependence on qualitative dosage is the fallacy that will retard the recognition of this important development in modern therapeutics.

From past experience with other technical problems in this field it is certain that dosimetry in short wave therapy will soon have its practical demonstration. Within the past decade orientation in this form of radiation was dependent on the invention of measuring instruments, which in turn acted as an impulse and guide for newer research. For determination of wavelength, the resonance circuit was introduced as the most accurate method of measurement; for indication of resonance, the neon lamp and dipole were found most suitable; for current output, the thermomanometer; for voltage, the string electrometer; for short wave output, the colorimeter; for wave form, the cathode ray oscillograph, and for temperatures the alcohol thermometer and the thermocouple. At the recent international congress in Vienna, nine independent papers were presented on the problem of dosimetry in relation to the therapeutic application of short waves. The great number of discussions and the variations of methods utilized to solve this problem is an index of the renewal of interest shown in its solution, its difficulties as well as its importance in clinical practice. This new aid

in the heat measurement of short waves was pointed out as an essential factor for the controllable administration of short wave diathermy, an aid which must meet both the economic and scientific demands of the profession

Of the many presentations just referred to, one by Mittelmann has fulfilled the most essential requirements for clinical purposes. This author, whose article appears elsewhere in this issue, recognized that the energy absorbed by the patient placed between electrodes depends to a great extent on such electrical factors as loss resistance and capacity of the patient himself. The usual apparatus for the measurement of currents and their tension is inadequate for dosimetry, because with the electrodes spaced from the body an essentially larger current is measured than the one that reaches the subject. Proposals to utilize measurement of damping, such as are employed in high frequency physics have the disadvantage of not registering the used up energy during but after the completion of a treatment. This method has also the serious drawback that it does not take into account the radiation decriment of the current, which depends on tension.

Mittelmann found that a real measurement which can be applied at any desired period can be acceptable by physicians only if it registers solely the energy that is absorbed by the treated subject. For this purpose he has constructed in the interior of a suitable short wave apparatus a tube volt meter and an auxiliary transmitter which together present an arrangement for determination of renonance excess in oscillatory circuits. This in turn is strictly limited to a finding affecting the circuit proper which represents its loss resistance. When the patient is placed between the electrodes the resulting increase of loss resistance is at once registered by a deflection of the needle of the meter according to a definite mathematical formula. On this basic concept Mittelmann has succeeded in contributing the first practical equipment and formulation for the interpretation of the various instrumental indices which enable the physician to determine the dose of short wave current directly entering the organic living structures. The element of error is negligible. With such means short wave therapy will be removed from the domain of empiricism and promises to become a therapeutic method permitting that degree of exactness which is demanded for any scientific procedure. As a corollary the uncertainty of dosage as now determined through subjective and qualitative factors will be obviated.

THE CINCINNATI MEETING

The convention of the Congress held in Cincinnati September 20-24 was a noteworthy event. The most gratifying feature of the 1937 convention had a dual aspect. The character of the overwhelming majority of the papers read was of deeper interest to those engaged in the solution of abstruse problems than to the rank and file of the medical profession, yet it was evident from the first that the many general practitioners and specialists who attended the scientific deliberations took as deep an interest in the biologic characteristics of the diverse methods of treatment as in their clinical applicability. This is in part substantiated by the fact that apart from the large registration the list of physicians who presented applications for membership in the Congress added a highly desirable class of colleagues as coworkers in the field of physical therapy. To those of our pioneers who for the past two decades have bent every effort to raise the standard of this branch of medicine and surgery from empiricism to an art and science on a secure anatomico-physiologic fundament this concrete evidence that their trials and tribulations have brought forth excellent fruit was a realization of their aspirations. Nor was this evidence limited to colleagues residing in Cin-

cinnati and vicinity, for many new members and visitors had come from our two opposite littorals and from the far north and south of our country to say nothing of those who had crossed the Atlantic to receive or impart first hand information. And the tribute paid the essayists and the discussants was as cordial to our foreign guests as it was to our own fellows, and this irrespective whether the presentations dealt with experimental problems or clinical observations.

No less gratifying was the presence of the President and of the President-elect of the American Medical Association who had come from their respective homes to encourage our labors by their official approval. Their earnest and carefully considered addresses delivered to a multitude at the festive board were an inspiration as well as a tribute to the achievements of the men who have enriched physical medicine by their conscientious labors and painstaking efforts in untrodden fields of research. The demand uttered by these distinguished representatives as well as by the incoming president of the Congress, that the time has come when medical schools must consider courses in physical therapy as an obligatory rather than elective part of the curriculum as a *sine qua non* for the education of physicians, should have been fulfilled long since. It is therefore heartening to see that the highest authorities recognize the inadequacy of general therapy without the armamentarium available in physical therapy. The statements voiced at the Congress and the cooperation of the concerned committees of the American Medical Association can no longer be ignored by those medical schools which are lagging behind our foremost seats of learning.

The scientific exhibits surpassed in numbers and space the boldest expectations and revealed even on cursory examination a quality of utmost value not only to clinicians but to all engaged in research in physical medicine and allied sciences. The commercial exhibits, too, were memorable qualitatively and quantitatively, as indeed they offered many new and interesting features. The auditoria at the Netherland Plaza hotel for the general and group sessions were more than adequate in size, easy of access and offered a suitable and air-conditioned environment for the customary demonstrations.

The scientific program having been published in the ARCHIVES there is need only to report that the diverse symposia and individual addresses were given before large audiences and elicited lively discussions at times of a critical nature. Apparently of especial interest to many was the last general afternoon session devoted to problems of short wave diathermy. Opposing camps had concentrated their forces for mental combat and brought up their heaviest artillery to gain a victory and wrest disputed territory from the opponent, but when an armistice for the duration of a year was signed by the gavel of the presiding chairman, it was evident that the opponents were merely retiring to gather new ammunition for the next annual resumption of hostilities.

Proof of the care with which the authorities of the Congress select both active and honorary members is found in the fact that after prolonged and careful deliberation the Committee on Awards were able to accord the highest honor of the Congress, the gold key of merit, to only two foreign scientists, whose names and citations are published elsewhere in this issue. The Committee on Awards for Scientific Exhibits, headed by Dr. Madge McGuinness, confessed in their formal and descriptive report that they had great difficulty in singling out exhibits for the few available medals and certificates of recognition. A very brief resumé of that report is also published in this number. And so it may be said that from every point of view the convention in Cincinnati proved a noteworthy event in the field of physical medicine.

THE CONGRESS AND PHYSICAL THERAPY *

FREDERICK L. WAHRER, M.D.

MARSHALLTOWN, IOWA

To be the recipient of the highest honor within the gift of a learned national body like the Congress means the acceptance of a responsibility, and while I am keenly appreciative of your trust and confidence, I am fully aware of the obligation imposed by the office. In expressing my gratitude to you I also make the pledge of doing all in my power to further the interests of the Congress during my incumbency, which means also your interests, individually and collectively.

This suggests the advisability of planning some policies of the Congress both with reference to the medical profession as a body politic and to our bona fide membership.

The scientific evaluation of all physical therapeutic procedures and the perfection of apparatus and instruments for their technical application have developed modern physical therapy to a state which can properly be referred to as standardized. By this I do not mean to convey the impression that physical therapy has reached the very acme of perfection and that its domain has expanded to an all-embracing area, for science — and physical therapy is a science — is limitless. Were it otherwise, it would not be a true science.

In surveying our realm we note with satisfaction that physical therapy is not only an integral part of general medicine and surgery, but has become an indispensable adjunct in the various recognized specialties. Thus the ophthalmologist, the otolaryngologist, the neurosurgeon, the urologist, or the gynecologist, to mention only a few of the representatives of specialized medicine, if they are at all progressive know that they are neither well equipped nor able most effectively to accomplish the management of many of the affections they are called upon to treat, unless they command the knowledge and means to give their clientele the benefits of at least certain physical therapeutic procedures.

Indeed physical therapy apparatus have become as indispensable to both general practitioners and specialists as the stethoscope, the ophthalmoscope, the manometer, the entire stock of galenicals, sera and vaccines, not excepting the scalpel and other surgical instruments in general use for the recognition and treatment of the diseases the human race has to endure.

In the light of what has been said, the important question suggests itself as to how the physician of tomorrow is to make intelligent use of the manifold, complicated physical therapy apparatus if the medical student of today is not familiarized with the rationale, the biophysical fundamentals of this form of therapy, nor with the technical manipulation of the equipment. It is indeed a lamentable fact that while undergraduate medical instruction in the United States has reached a high level, there are only a few of our medical colleges in good standing that afford their junior and senior students the training required for the scientific application of physical therapy. It might be held that here we have to deal with a specialized branch of medicine which each graduate is supposed to study after he has entered upon his career, but this proposition is not only untenable but downright harmful. Supposing the young physician does hear or get a glimpse of the beneficial effects of physical measures in the management of disease, is it really credible

* Presidential Address delivered before the American Congress of Physical Therapy, Cincinnati, Ohio, September 20, 1937.

that he will leave his office for a more or less protracted stay in some medical center where he can secure the necessary knowledge? I fear not, nor can it be expected of a young colleague beginning to lay the foundation for his vocation. But what is worse yet, is the inescapable fact that not having seen the subject included in his curriculum, he naturally has gained the impression that physical therapy can have but insignificant value, if any, as otherwise his teachers certainly would have stressed its importance. And the text books which he had to use by authoritative edict on the part of his dean and faculty cannot be said to contain adequate information to have brought him enlightenment.

Under the circumstances I deem it a very important policy of our Congress in the interest of the future of medicine and surgery to bend its energies in cooperation with the concerned committees of the American Medical Association to induce all recognized regular medical schools in our great land to add to their present curricula also the subject of physical therapy. I do not by any means imply that the faculty should add unbearable burdens on the already overworked older medical students nor deprive other subjects of the time needed to place the knowledge of the student body on a solid basis, but what I do make a plea for, is to present to the students the subject of physical therapy in easily digestible form and in a manner to enable them to appreciate its indications, biophysical effects and manner of use, so while whetting their appetite for more detailed knowledge they will have sufficient grounding in the essentials to be able to perfect themselves by the use of the contemporaneous literature without stumbling over the usual pitfalls incident to autodidactic instruction.

I pledge you my very best efforts during the coming year in the hope that with your valued cooperation and backed by the American Medical Association we will attain the desired goal.

Permit me now to cast a swift glance at the medical profession of today. While the Congress in the past sixteen years has made rapid strides in a forward direction, and while physical therapy has been worthily appraised by great responsible bodies and by individual authorities in our profession, it cannot be truthfully asserted that it has become the general property of our medical body politic. To gain the interest of the more than hundred thousand ethical physicians of the United States, the Congress must adopt another policy of extending its influence through its official publication, the Archives. Please understand that I am fully cognizant of the fact that under the able direction of its learned editor the Archives has acquired an enviable reputation for the dissemination of scientific facts and for high grade scholarship not only in the United States but in all countries, but what I feel it does need is a greater economic support to provide for larger issues in a quantitative sense and the means of getting out from time to time special numbers prepared to arouse all physicians to a realization of their responsibility in relation to the clinical employment of the manifold physical procedures.

Specifically I have in mind among others the application of the high frequency currents to surgical operations. It is noteworthy that while some of the leaders in specialistic surgical fields have preached in season and out of season that in certain types of neoplastic disease the cutting and coagulating currents offer therapeutic and prognostic advantages unattainable with the classic methods of operating with scalpel and scissors, even great institutions have failed adequately to make use of them in positively indicated circumstances. And that holds even more with surgeons in general. Here the addition of pages in the Archives to further this newer method in surgery, which the Congress has sponsored for a number of years, may prove very fruitful. The publication of special issues devoted to such newer trends as

iontophoresis, short wave diathermy, low frequency currents and correctional mechanics certainly will afford the medical profession down to date critical reviews of these methods.

And now permit me an earnest word addressed to our own members. I am the last man on earth to minimize the importance of specialists in physical therapy. On the contrary I am cognizant of the fact that it is to the scientific workers that modern research has turned for real biophysical and clinical advancement. But physical therapy is too valuable to be confined to a comparatively small number of specialists, what I earnestly stress is, that the concept that physical therapy is the *ultima ratio* in medicine and surgery is erroneous, even though it is attributable to enthusiasm, and that it is improper to devote detailed consideration to one particular remedy at the expense of the older and simpler agents. In other words I am opposed to the trend that has so often appeared in general medicine of devoting all of our energies to some one new idea and taking older methods for granted.

May I express in conclusion the hope that before the expiration of my term as your presiding officer, I will be found to have fulfilled my duty in furthering the cause of physical therapy along the lines I have outlined. Rome was not built in one day, and I do not anticipate the realization of the impossible, in one short year. But if the thoughts I have submitted for your kind and earnest consideration should bear fruit in the sense of your hearty support, I shall be content to rest the future in your hands.

Dr. Gustavus M. Blech Honored

The readers of the ARCHIVES will no doubt be pleased to learn that our associate editor, Dr. Gustavus M. Blech, has been the recipient of an honor usually only bestowed on royal personages or the highest ranking officials in the public services. Having been awarded in 1932 the decoration of a knight commander in the royal order of St. George, he was recently elevated to the highest dignity in the order and invested with the grand cordon and great star of a knight grand cross, an honor bestowed this year only on the King of Italy. Such was the evaluation of Dr. Blech's services to military surgery that instead of following the custom of raising a knight commander to the next higher dignity of a knight grand officer, His Most Serene Royal Highness the Duke of St. Simon, in his handwritten citation notified Dr. Blech that an exception has been made in his case and the supreme honor was awarded him at a solemn conclave held in Brussels, Belgium. We felicitate our colleague on this extraordinary but merited distinction. Dr. Blech is the possessor of the Grand Cross of St. Stanislaus, of the Legion of Honor of France, of the Imperial Order of St. Anne, owns the decoration of an officer of public instruction and a number of other civil and military distinctions, but assures us that he takes great pride in having been awarded a few years ago the Gold Key of Merit of the Congress.

Encephalitis Virus Grown in Test Tube

The virus of encephalitis, recently epidemic in St. Louis, has been grown in a test tube for the first time. The method by which this was achieved is reported by Drs. Jerome T. Syverton and George P. Berry of the University of Rochester School of Medicine and Dentistry.

Development of a means of growing this disease "germ" in a test tube or laboratory dish will mean that scientists investigating the virus no longer need to use animals to keep the strain alive for their experiments. The "food" on which the test tube virus was kept alive was made from embryonic mouse tissue, normal rabbit serum and a solution containing calcium, magnesium and similar chemicals. — *Science News Letter.*

Dr. William Wilder Hopkins

It is with profound regret that we chronicle the demise of Dr. William Wilder Hopkins, of Geneva, New York, on July 5, 1937. Dr. Hopkins was one of the oldest and most respected members of the Congress. He was graduated from the New York Homoeopathic Medical College, New York, in 1895, and was engaged in the active practice of medicine uninterruptedly until his death at the age of sixty-seven. He specialized in radiology and devoted a good deal of his work to physical therapy. He served creditably as a medical officer of the Army during the World War. We extend to his family our sympathy in their bereavement.

THE STUDENT'S LIBRARY

JUVENILE PARESIS. By *William C. Menninger*, M.D. The Menninger Clinic Monograph Series No. 1. Cloth. Pp. 199 with 16 illustrations. Price, $3.00. Baltimore: Williams & Wilkins Company, 1936.

The author's study of juvenile syphilis in the form of paresis is based on forty-three patients personally observed by him and six hundred and ten cases presented in the concerned literature. The work encompasses every phase of this serious malady. Of especial interest is the chapter on treatment because it offers a rather critical review of the experiences gained with hyperpyrexia by diathermy in eight young patients afflicted with paresis. While the author recognizes that the number is comparatively small, yet in comparison with other methods no doubt is left that so far as therapeutic results are concerned hyperpyrexia eclipses every other method of antiparetic therapy. At the same time the author does not fail to emphasize the importance of combined therapy in which in addition to artificial fever tryparsamide, bismuth and occasional series of administrations of neoarsphenamine have a place. One can only support the contention of the author that the treatment must not only be intensive but continued over a long period of time without an interruption as a rest period. This small monograph presents a complete survey of our present knowledge of paresis in juveniles and can be recommended to all interested in the nature and management of this disease.

KURZWELLEN - SCHWACHBESTRAHLUNG. (Short Wave Weak Radiation.) Eine Anlestung Fur Den Praktischen Arzt. By *Eugen Weissenberg*, M.D., Assistant in Charge of the Short Wave Department, University Neurologic Clinic in Vienna. Pp. 67, with 26 illustrations. Price, Rm. 4. Vienna: Wilhelm Maudrich; Chicago: Chicago Medical Book Co., 1937.

The stormy period through which recognition of the deep heating possibility of short wave therapy has just emerged makes one view the latest demonstration of its clinical efficiency by practically heatless dosage with a certain amount of misgivings and to wonder whether this also will be forced to await unfavorable or delayed adjudication. Weissenberg's brochure on the clinical and physiologic effects of short wave emission of weak or non-heating intensities stimulates a train of new speculations of the properties inherent in short wave radiations in which the heating factor is practically negligible. It produces the uncomfortable conviction that once again the medical profession will have to adjust itself to a new evaluation of the effect inherent in this range of energy with dosage so minimal as to be associated with no heating of the tissues treated. Fully appreciative that his thesis runs counter to current opinion, the author has introduced laboratory observations to confirm his clinical findings in over 4,000 patients treated at the short wave department of the neurologic clinic at the University of Vienna, in order to demonstrate that the prompt relief of pain and restoration of function was not psychogenic but physico-therapeutic in nature. In the space of seven richly illustrated chapters, Weissenberg conservatively evaluates and clearly analyzes the physical nature, physiologic responses and clinical improvements of short wave low intensity dosage therapy on a variety of diseased conditions that practically includes every system of the body. Case histories are interpolated in the text to illustrate its therapeutic efficacy in diseases of the nervous, respiratory, cardiovascular, digestive, genito-urinary, muscular, and other systems. That this method of short wave application is not a panacea for all ills, is pointed out in the last chapter, in which its contraindication is tersely described. Undoubtedly this small book will be regarded by some as a radical innovation and its claims questioned and further proofs demanded. The hope is advanced that those demanding proof will first acquaint themselves with the author's conservative evaluation and his technic, and meet this new therapeutic challenge with labors of a similar character. Small in size, the book is nevertheless the most thought provoking contribution on the subject of short wave therapy published in any language.

ELECTRICAL SIGNS OF NERVOUS ACTIVITY. By *Joseph Erlanger*, Professor of Physiology, Washington University and *Herbert S. Gasser*, Director the Rockefeller Institute of Medical Research. Cloth. Pp. 221, with 113 illustrations. Price, $3.50. Philadelphia: University of Pennsylvania Press, 1937.

This volume represents the third of a series of lectures published by the University of Pennsylvania of the Eldridge Reeves Johnson Foundation for medical physics established in 1929 for the purpose of furthering our knowledge of the physical aspects of the medical sciences and their application to medicine. Although it deals with the important physiologic problem of the response of the nervous mechanism to electric stimulation and of interest to the medical profession because of its applicability to clinical conditions, it also conveys in a parenthetic manner an eloquent sermon of the democracy and sweet tolerance of the scientist toward his fellow laborer. Written by outstanding authorities who were from the first at odds regarding the interpretation of the very facts required of them to collaborate, they were nevertheless able to survey the problem in its broadest aspect without relinquishing their individual viewpoints. This was accomplished by dividing the exposition into two

parts, each supporting the other to the extent of bringing unity to the subject, but otherwise contributing the experiences of the author under his own signature. The discussions are monographic in style, its contents indicating that three of the five large and tersely written chapters are those of Erlanger, while the remaining two, of Gasser. How the nerve responds to the nature of its anatomic configurations, as well as to the extraneous electrical methods employed to measure these responses, is the basis of this thesis and helps to clarify a problem of daily interest to the physiologist and the medical profession. From a diagnostice point of view the neurologist and the physical therapist are particularly cognizant of the importrance of electric stimulation. Hence these groups will particularly appreciate the scholarly interpretations of the compound action potential of nerves, the physiologic character of nerve fibers and their excitable range, and their determination by the galvanic and the Lapicque currents. To those of the profession especially interested in the meaning and mode of action of chronaxie, the summation period of nerves to shock-response, the effect of excitation and depression by the constant current, and a better appreciation of what Gasser describes as the excitability cycle, this book is warmly recommended. The work as a whole is a tribute to the high scholarly standard set by the University and the Foundation sponsoring these lectures and publications.

THE 1937 YEAR BOOK OF RADIOLOGY. DIAGNOSIS. Edited by *Charles Waters*, M.S., Associate Editor, *Whitmar B. Firor*, M.D.; THERAPEUTICS. Edited by *Ira I. Kaplan*, B.Sc., M.D. Cloth. Pp. 503 with 550 illustrations. Price $4.50. Chicago: The Year Book Publishers, Inc. 1937.

Perusal of the 1937 edition of the Year Book of Radiology evokes the same if not a greater amount of admiration as was voiced in past reviews, for it has set the standard of literary achievement in this field. The collaborators have again presented the very essence of the important and practical contributions in radiology from both its diagnostic and therapeutic angle. Increasing publications and their evaluation justified the addition of Firor as associate editor in diagnostics in order to lighten the labors of Waters, but it is hoped that the section on Therapeutics will be maintained intact because the rich and broad experience of Kaplan lends authority to his terse evaluations. The present volume offers an instructive cross-section of the trends and purposes in diagnosis and therapy. The diagnostic art is shown to have expanded, due to newer concepts and methods related to practically every system of the body. There is generous space devoted to the diagnostic efficacy of opaque substances to observations of the effects of drugs in the gastro-intestinal and urinary tracts, to the observation of bismuth deposits on bone, and the like. The section on therapeutics presents a revivified panorama of new methods, measured as in the past by the trial and error yardstick. Kaplan evaluates these for their lasting possibilities in the treatment of malignant and benign conditions. He points out that cancer is still the unsolved problem, but is attracting greater efforts towards its solution; that heat by short waves applied before irradiation definitely creates a "higher sensitivity in the neoplastic tissues treated;" that proof of the beneficial effects of x-ray is so substantial as to warrant its use in a large variety of acute and chronic conditions heretofore left dependent upon the uncertainty of pharmacotherapy or its adjuvants. Here is one book, therefore, that should be on the "must" reading list of every physician.

DAS VENTRIKULOGRAMM. Von *Erik Lysholm*, Dozent für medizin. Radiologie; *Bertil Ebenius* und *Hans Sahlstedt*, Assistententen am Röntgeninstitut. Part I, pp. 74. Price Sw. cr. 10. Part II, (subtitle: Die Seitenventrikel). Pp. 199. Price Sw. cr. 15. Stockholm: P. A. Norstedt & Söners. Förlag, 1937.

The two monographs are paper bound supplements to Acta Radiologica. The first part, which was published about a year before the second, should have been reviewed in the ARCHIVES long since, but the reviewer decided to delay this until the second part became available, in order to present to interested readers an idea of the scope of this unusually important work. It is common knowledge that not a few radiologists who have little experience with the diagnostic methods demanded by present day neurosurgeons scarcely have an opportunity to become familiar with the roentgenographic appearance of the ventricles of the brain after they have been aspirated and inflated with air for the diagnosis of tumors. The two small monographs therefore afford not only radiologists but also neurologists and especially neurosurgeons the information needed for the proper interpretation of ventriculograms. The first of these though devoted to the roentgenologic technic offers even more in that it gives both in word and picture the anatomic basis in a manner which for lucidity leaves nothing to be desired. The second monograph is to all intents and purposes a combined atlas of ventriculograms and a clinical report on every conceivable type of brain tumor. Both books provide about 350 actual photographs and diagrams to facilitate interpretation of the radiographic plates and the manner of using the x-ray apparatus. While the descriptive text of the symptoms of the cases presented is limited to essentials, the comments on the plates obtained by ventriculography are sufficiently detailed to facilitate self-instruction. To those interested in the concerned problems the small manuals are a rich mine of information.

INTERNATIONAL ABSTRACTS

Low Intensity Short Waves (11.3 Metres). Preliminary Observations Concerning Their Effects on Living Tissues. P. P. Dalton.

J. Phys. Med. 11:221 (April) 1937.

In England as in America the issue of the existence of any specific effect in short wave radiation outside of heat has divided students of the problem into opposite fields. Attempting to bring further light on the subject Dalton invoked the laboratory method of the physiologist to arrive at an orientation acceptable to those who are interested in scientific methods in medicine. He first points out that the dispute on this problem is still unsettled; that high wattage generators tending to produce a great volume of heat often have obscured the very nature of these irradiations. To prove his thesis he utilized an instrument of 11.3 metres whose emission power was only several watts in strength, producing a so-called non-heating action upon living material. By this method he showed that an "influence was excited and an effect produced" upon the living nerve of a frog. The effect so produced did not resemble that which is associated with a heating action nor a fatigue response coupled with polarizable electrodes. Dalton therefore concludes that he has demonstrated a specific effect of short wave radiation.

Diathermic Treatment in Peripheral Arterial Insufficiency. Gardner S. Reynolds.

Minnesota Med. 20:379 (June) 1937.

Reynolds asserts that he has found in peripheral arterial insufficiency an arterial reserve function or dilatability comparable to the functional reserve of the heart. When a heat load is impressed upon an extremity, by means of diathermy, the arterial system under these conditions seems to dilate to the maximum of its capacity before damage from overheating is permitted to occur. When the application of diathermic heat is continued the circulation of the extremity is improved. In Raynaud's disease the improvement is thought to be due to relaxation of the arterial wall with restoration of the normal lumen, while in arterial sclerosis the improvement in arterial circulation is probably due primarily to the establishment of an adequate or collateral circulation. In Buerger's disease it is probable that both the lumens of the original vessels are improved and compensatory circulation established.

Diathermy applied in the manner described by the author is the best local therapy for arterial insufficiency of the extremities. It is definitely constructive and the effects appear to be lasting. In many cases of organic arterial insufficiency this method of diathermic treatment is almost specific. Arteriosclerosis shows less improvement with this method than the other two types of arterial insufficiency. The patchy type shows greater improvement under this treatment than the more uniform one. Patients of middle or of older age, in whom an incipient arteriosclerotic gangrene is evident in the extremities, should not be treated by diathermy if their tolerance is down to or below 40 per cent of normal. In such cases the gangrenous process develops at a more rapid rate than can be counteracted by diathermy treatment.

Hyperpyrexia in Treatment of Syphilis. William Bierman.

Letter to the Editor J. A. M. A. 108:666 (Feb. 20) 1937.

In Queries and Minor Notes in the Journal January 9, M. D., California, writes of hyperpyrexia in the treatment of a case of syphilis resulting in the death of his patient.

From my experience in the treatment of a large series of cases with physically induced elevation of systemic temperature, and from the data contained in this communication, I feel that it is necessary to call attention to the following facts:

1. A mouth temperature of 106 degrees F. is extremely dangerous because, while in the grand average of cases the systemic temperature as measured by rectal thermometer may be within 1 degree F. elevation beyond the mouth temperature. It not infrequently happens in an individual case that the rectal temperature may be as high as 2 degrees F. above that indicated in the mouth. Mouth temperatures must be taken very carefully because of the cooling effect of the air passing in and out of the respiratory tract. In other words, this patient's temperature may have been 108 degrees F. or even higher by rectum. One-fourth grain (0.016 Gm.) of morphine sulfate was administered hypodermically after the patient's mouth temperature had been elevated to 106 degrees F. There is no notation of temperature during the next thirty-five minutes. An increase in the temperature following the administration of morphine is usually observed unless steps are taken to increase heat loss or to diminish the amount of heat applied. It is also of interest to note that the pulse rate, which at 10:45, when the mouth temperature was 104.4 degrees F., was 140 beats per minute, at 11:10, when the mouth temperature had risen to 106 degrees F., diminished to 104 beats per minute.

2. In the narration of the management of the case, reference is made to the fact that a technician was left in charge of the case at these temperatures. The communication states that "stim-

ulation was applied as much as a technician could apply." In my opinion it is imperative that a physician who is specially trained in the administration of physically induced temperature elevation be continuously present during treatment and until the temperature is permitted to recede to below 104 degrees F. or, better still, to below 103 degrees F. (rectal temperature). This is a major procedure wherein the development of changes leading to death may occur within a few minutes. This makes it necessary to observe the systemic temperature at frequent intervals — at least every ten minutes or, preferably, continuously by means of the special registering instrument available for the purpose. This instrument as well as clinical thermometers must be frequently checked because so much reliance is placed on the absolute fact of the temperature observed. The physician in attendance should also be prepared to administer emergency measures to forestall a fatal termination. It is hardly just to the technician to expect him or her to be possessed of all the necessary medical background as well as the exact information so as to be able to act in such emergencies. Certainly it does not appear to be just to the patient.

If patients are to continue to receive treatment such as that described and under the circumstances mentioned, one may reasonably expect an increasing number of deaths due to the exceedingly high temperatures employed rather than to any special peculiarities in the reactions of the patient. A therapeutic procedure that is showing much promise in the treatment of important diseases may well come to be thrown into the discard because of the lack of care used in its administration.

Highlights of Physiotherapy in Ophthalmology. Samuel Morse.

M. Rec. **144**:259 (Sept. 16) 1936.

The author experimented with a 6-meter short wave diathermy with excellent results in acute iritis, glaucoma, idiopathic orbital pains (traumatic and otherwise) and episcleritis.

He found that short wave diathermy definitely relieved pain due to nerve inflammation and injuries which have a tendency to become chronic. It is very valuable as a lymphatic stimulant, and its action is greatly superior to the use of dionin in these cases. Above all, short wave diathermy affords relief in almost every painful condition of the eye.

Several hundred cases were treated without any untoward results, the 6-meter wave having been applied two inches from the eye, and two inches from the back of the head, or across the orbits with the condenser electrodes the same distance away. In one case of acute iritis of several days duration, and where treatment with hot applications and atropin had no effect, the patient was relieved of pain after a ten-minute treatment of short wave diathermia. The author recommends this energy to ophthalmologists as an addition to their therapeutic armamentarium as the best means of obtaining relief much quicker than can be had by all other known measures in the same conditions.

Carcinoma of Tongue. Frank R. Spencer.

Arch. Otolaryng. **24**:1 (July) 1936.

Electrosurgical excision of carcinoma followed by irradiation is indicated in growths of early development. In the group of 14 cases reported, 6 had involvement of the base of the tongue and adnexa, adding greatly to the difficulty of surgical removal. Early cancer of the tip of the tongue is more amenable to surgical removal. New, Broders and Childrey treated 52.52 per cent of the malignant growths on the anterior two thirds of the tongue, but only 7.68 per cent of those involving the base and the hypopharynx.

A review of the literature shows that definite progress is being made when electroexcision is the method of operation and the disease is recognized and treated early. Broder's classification is a real help in outlining treatment. The consensus of opinion is that surgical diathermy has been a definite improvement over the cautery, although it has not, and should not displace it entirely. Irradiation by high voltage roentgen rays is an improvement over the low voltage irradiation, just as the radium bomb or teleradium is an improvement over small quantities of radium. The recognition of the importance of syphilis of the tongue in causing cancer and of carious teeth with poor dental hygiene will do much to prevent and relieve the suffering from lingual carcinoma.

New Nasal and Aural Applicators for Heat Therapy. Conrad K. Gale.

Laryngoscope **46**:557, 1936.

Gale describes two new types of nasal and aural applicator which can be used with any apparatus incorporating the Elliott water circulation principle. Hitherto, this form of therapy in its application to nasal and sinus therapy has been inadequate because of failure to recognize the importance of nasal anatomy in relation to the nasal applicators. Gale constructed applicators which would have a maximum contact with the nasal mucous membrane. When it is recalled that all the sinuses form immediate boundaries of the nasal cavity, heat application to as large a surface as possible must necessarily have a maximum effect.

Pneumonia. J. O. Fitzgerald, Jr.

Virginia M. J. **63**:746, 1937.

In May, 1936, pneumonia led the Virginia death rate. This is a month in which we do not expect much pneumonia in this climate. The treatment of pneumonia is in no way stereotyped, and different men and clinical groups have their own ideas. Serum is available for only two of the now recognized thirty-two types of pneumococcus infection, and, of course, there is no serum for the varieties of other organisms causing inflammation of the lung.

In recent years the author has used diathermy (either conventional or short wave) not as a treat-

ment per se, but in connection with any other indicated treatment.

A few general effects which occur almost constantly in pneumonia cases treated by diathermy are a distinct lessening of pain and a consequent deepening of breathing. If cyanosis exists the color improves, and the patients express satisfaction with subjective improvement. Sweating is often increased. Increased fluid intake is fairly constant, but whether or not it is due to increased fluid loss is not known.

Within two hours after treatment there is increase in both pulse rate and temperature. These increases are small and are followed by a return to nearer normal than existed before treatment.

Expectoration is generally made easier. It becomes thinner and the amount is increased. Sound, restful sleep of one to three hours follows most administrations.

Diathermy is usually followed by lysis rather than crisis. Reduction in mortality has occurred so often and with such regularity that it needs especial mention. Every writer on the subject stresses the importance of beginning diathermy early.

A total of eighty cases have been treated. Ten of these died—a mortality rate of 12.5 per cent. Four of these deaths were in patients very ill before pneumonia developed. Two were post-operative patients with general peritonitis, one from a ruptured appendix, the other from a perforating duodenal ulcer. Neither lived twenty-four hours from the beginning of treatment. Another had cancer of the stomach and was thought to be almost well of pneumonia when he vomited a large amount of blood and died suddenly. A fourth was a seven weeks old infant who developed meningitis. Without including these four deaths the mortality rate was 7.5 per cent.

Observation on the Tuberculous Larynx. Franklin P. Schuster.

Arch. Otolaryng. **25**:23, 1937.

In the treatment of tuberculous laryngitis one must remember that one is treating a secondary infection from a primary focus in the lung. Therefore, attention to the lungs should receive primary consideration. However, as this secondary invasion of the larynx frequently determines the final issue, it is important to attack it vigorously, along with the treatment of the primary focus.

Even whispering may be harmful, as Carmody has pointed out. Attention should be given to hygiene of the nose and throat, and a simple, generous diet, rich in vitamins A and D, is important. When pain and dysphagia are present, it is essential to give relief and to see that the patient receives sufficient food and fluids to maintain the general condition. Many of these patients actually fear to eat on account of the acute pain on swallowing. It has been noted that patients have individual idiosyncrasies in this regard. One may be able to take liquids freely and have trouble with solid or semisolid food. In many cases the reverse is true. Many can swallow cold or tart food and others only sweetened foods. This must be worked out in the individual case. Again, swallowing is sometimes made easier by hanging the head over the edge of the bed, so that the head is lower than the body, and taking food through a straw (the Wolfenden position). Others are helped by tipping the head backward to a position similar to that used in feeding intubated patients.

In the early stages general care, absolute rest of the voice and the application of any oily substance to the membrane have given the best results. Lukens has reported favorable results with chaulmoogra oil. It is the author's opinion that in the early stages there is much more danger of overtreatment than of undertreatment.

Wessely in Vienna and Miller, Katz and other authors in this country have reported favorable results by the use of quartz and other types of ultraviolet lamps, the radiation being directed into the larynx largely under direct methods. Most of the patients do not tolerate direct laryngoscopic examination well, especially when this has to be done repeatedly, and there is also danger of trauma and extension of the tuberculous processes. Roentgen rays and radium have been advocated, but their use is not without danger.

Another procedure found valuable is rather out of the laryngologic field. This is collapse of the lung, by phrenic evulsion, pneumothorax, or thoracoplasty.

Treatment of Pulmonary Abscess with Short Waves. Salvatore Fiandaca.

Brit. J. Phys. Med. **12**:25 (June) 1937.

Treatment by short waves, based upon the results so far obtained, can be considered as certainly efficacious in the treatment of lung abscess. Treatment must be applied with proper technical skill and in relation to the pathogenic nature of the lesion. Want of success in cases treated does not exceed 18 per cent, and almost all these were cases of abscesses due to bronchiectasis. Treatment by short waves offers noteworthy advantages over other means of treatment: easy application, practically no discomfort to the patient and possible ambulatory treatment for the patients in certain general conditions.

Studies in Rickets. Clinical Findings in 1,000 Private Patients. C. Ulysses Moore, and H. G. Dennis.

California and Western Med. **44**:288 (April) 1936.

Mild rickets is more common than is generally appreciated. Lack of vitamin D is the most important factor in the etiology of rickets. In man, vitamin D is formed by the action of ultraviolet light on the lipoids of the skin. Our habits of life prevent sufficient utilization of the available ultraviolet rays by the body. The amount of ultraviolet light available depends on latitude, climate, and atmospheric conditions. Portland, Oregon, has low average annual sunshine and atmospheric conditions which impair its usefulness. At least 97.6 per cent of one thousand private patients examined had one or more clinical signs usually associated with rickets. Of these, the chest signs, beading, groove, and costomalacia were most common. The greatest number of clinical signs were found in the most

rapidly growing parts: first the head, then the chest, and later the feet and legs. Under our present dietary and living conditions, the antirachitics so far in general use have been unable to prevent a high percentage of mild rickets. Perhaps the universal use of vitamin D milk will accomplish this. If an improved skeletal development is to be attained in the coming generation, the medical profession and the laity must be awake to the prevalence of bony imperfections and be alert to apply available preventives.

Fever Therapy in Ocular Manifestations of Syphilis. Albert N. Lemoine.

J. Oklahoma M. A. **29**:309, 1936.

The hot bath method for the production of hyperpyrexia in the treatment of chronic syphilitic manifestations of the eyes appears to be as efficacious as that of inoculation with malaria, consequently it simplifies greatly the procedure of fever therapy and minimizes its danger.

The fact that fever therapy immediately ameliorated the symptoms, narrowed the vessels in the cornea, and in most cases diminished the congestion and the peri-vascular infiltration so rapidly, brought up the question of the *modus operandi* that is responsible for the results. There is probably something besides merely increasing the metabolic process in these cases. According to Schamberg and Rule, the heat causes death of the treponema pallidum.

Fever therapy relieves the symptoms and obliterates the vessels in the cornea in interstitial keratitis more rapidly than any other form of treatment. Syphilitic optic neuritis improves more rapidly than by any other form of treatment. Apparently hyperpyrexia arrests the progress of primary optic atrophy and in some cases even improves the vision and the fields, at least temporarily.

Physical Measures in Proctology. R. V. Gorsch.

New York State J. Med. **36**:1875, 1936.

Many patients with chronic ulcerative and so-called mucous colitis have a neurasthenic background and the importance of psychogenic factors in the etiology and treatment of these serious conditions deserves greater consideration. Abdominal diathermy, static wave current, ultraviolet irradiation, and other selected physical measures might prove useful for the comfort of these patients.

Fever therapy in the treatment of ulcerative colitis is at present under clinical investigation and there appears to be some evidence that it may prove of definite value. However, its exact status must be determined by a closer cooperation between the physiotherapist and proctologist, who should check the effects of the treatments by frequent proctoscopic observation.

Ultraviolet light for pruritus ani has been rather disappointing. While the x-ray is frequently advocated, the author is decidedly opposed to its use.

Medical diathermy is of considerable benefit in many cases of anorectal stricture, particularly those complicating lymphopathia venerea in colored females.

Theoretically electrosurgical methods would appear to be ideal in the treatment of hemorrhoids, but actually, they are decidedly less satisfactory than a clean ligature operation. The vast majority of hemorrhoids requiring surgery are complicated by chronic submucosal infection, sphincter spasm, fissures, large skin tabs, infected crypts, enlarged papillae, and prolapsing mucosa.

The galvanic current which supposedly produces an electrochemical caustic action in hemorrhoids has been used for many years. The author has long since discarded it, because of the number of uncontrollable and variable factors in the technic; further, because it is only applicable to a selected group of uncomplicated cases.

Simple uncomplicated fissures may be treated by diathermy. Relief sometimes follows the complete desiccation of the surface of the fissure with the Oudin current.

Continuous Registration of Rectal Temperature During Treatment in the Hypertherm. Wilhelm Stenstrom; Irwin Vigness, and Carl E. Nurnberger.

J. Lab. and Clin. Med. **22**:848 (May) 1937.

The inducement of artificial fever or hyperpyrexia has become a widely used method of treatment for patients suffering from general paresis, gonoccocal arthritis, and a few other diseases. Whichever method is used, it is of utmost importance to watch the temperature of the patient carefully. In most instances this is done by means of an ordinary rectal thermometer which has to be inserted and removed at short intervals. This is a very inconvenient method. A considerable amount of warm, moist air escapes during the process and a fluctuation in the temperature may thus be produced. A certain delay in obtaining the temperature is inherent in this method and that may occasionally lead to complications.

By means of electrical devices for measuring temperatures it is possible to read the temperature at any moment without delay and without disturbing the patient. Such devices are not suitable when short wave diathermy is used, but for all the other methods of inducing heat it is practical. The authors have found the thermocouple method very satisfactory, but a resistance type thermometer may be used instead. A suitable apparatus can easily be assembled after the few necessary instruments have been obtained. By means of a few simple additions and special arrangements it is possible to obtain continuous photographic registration of the temperature.